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CIAL PUBLICATION
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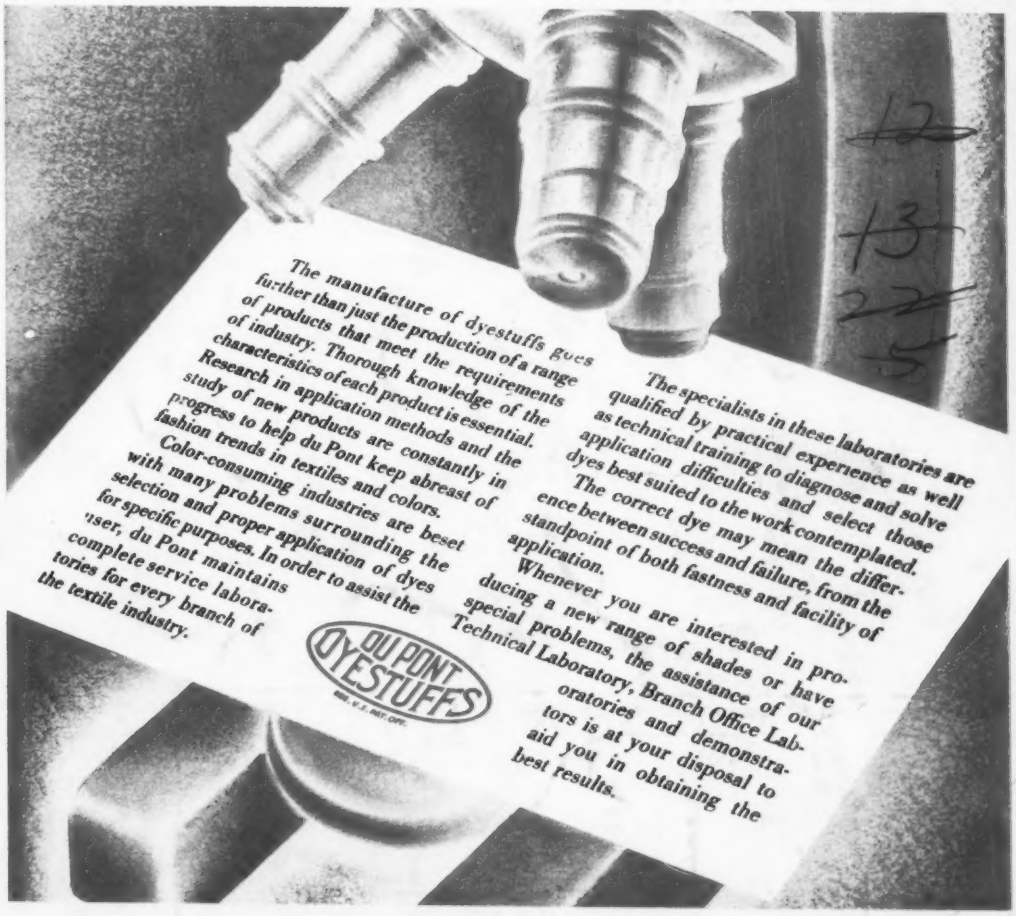
ICAN ASSOCIATION
EXTILE CHEMISTS
ND COLORISTS

AMERICAN DYESTUFF REPORTER

DU PONT TECHNICAL SERVICE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TO THOSE WE SERVE

AMERICAN
DYESTUFF REPORTER

VOLUME 27 DECEMBER 12, 1938 NUMBER 25

A Larvae Test for

Moth-Resistance of Mohair Piled Fabrics

and Woolens in General

CHARLES H. STITELER*

INTRODUCTION

MOTHPROOFING is a problem that affects every housewife, and through the housewife retailers and manufacturers. There are many existing commercial processes for rendering fabrics resistant to the destruction of moths; but the term "mothproofing" has been used loosely to cover almost any degree of protection. No general agreement exists as to the degree of protection that can be considered adequate mothproofing. Nor is there any test for mothproofing which can be used by different laboratories to produce check results. The following experiments have been carried on over a period of two years in an effort to establish an adequate test for mothproofing and as a possible aid in the development of a much needed standard for moth-resistance.

TEST PROCEDURE

Larvae Used in Test

It has been found that of the larvae generally used by various laboratories, larvae of the clothes moth (*Tineaola biselliella Hum*) and of the black carpet beetle (*Attagenus piceus Oliv.*) are most widely used. Larvae of the black carpet beetle are almost exclusively used in this laboratory since these attack anything that clothes moth larvae will and are easier to work with.

Among the disadvantages of the clothes moth larvae are:

1. High death rate due to handling.
2. Webbing material is deposited which tends to cover up damaged portions of the fabric.
3. Destruction of the fabric in order to build cocoons even though the fabric is well mothproofed.
4. More time is required for a test in order to get the same amount of damage produced by carpet beetle. larvae.
5. The larval period is about one-fourth of that of carpet beetle.
6. It is further believed although no confirmation of this has been possible, that moth larvae are forced prematurely into the pupae stage due to lack of food which would result on a fabric well mothproofed.

E. A. Back[2] and M. G. Minaeff[1] prefer the carpet beetle larvae.

TEST PROCEDURE

The test procedure originally adopted was merely to expose the fabric or yarn in question to the attack of ten clothes moth or carpet beetle larvae for a convenient length of time using in each case the same area of exposure for each test (approximately 1.5 square inches or 960 square millimeters). The larvae used were all about the same size and corresponded to half grown. The amount of excrement, by weight, resulting and the condition of the fabric after test were used from which to draw conclusions as described later. The larvae of the black carpet beetle were adopted as the best larvae to be used because of reasons given above.

The apparatus used for testing is extensively simple and is composed of ordinary crucibles with perforated bottoms which are found in every laboratory, inverted over the fabric after the larvae have been placed inside. The fabric is backed with any material which is inedible and a rubber band is used to hold the unit together as shown by the photograph.

PREPARATION OF SAMPLES FOR TEST

Samples of undyed fabric were treated with the following percentages of mothproofing agent: 5, 4, 3, 2, 1, 0.5, 0.12, 0.1 per cent based on the dry weight of the fabric. The samples were wet out over night at room temperature and then soaked in a water solution of the mothproofing agent for twenty minutes at 75° Fahrenheit. The water to cloth ratio was twenty-five to one. The procedure produces a large range of actual concentrations of the mothproofing bath from 0.2 per cent to 0.004 per cent and shows eventually the point where the minimum amount can be used in order to produce good mothproofing.

This range of concentrations or percentages covers the range used in mill operation from the application in the rinse water after dyeing. The fabrics were then squeezed

*Flori Mothproofing Method, Inc.

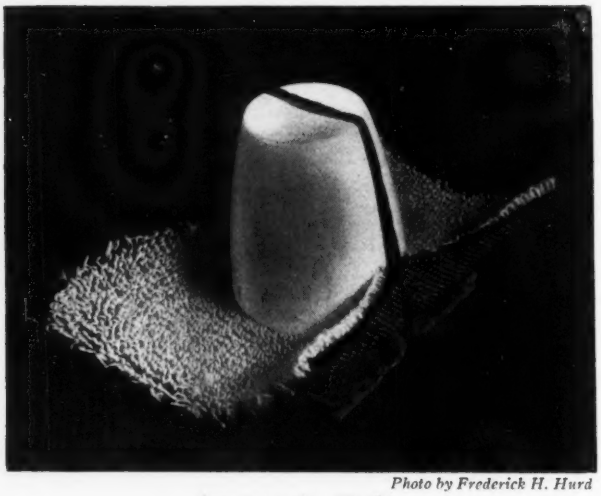


Photo by Frederick H. Hurd

Apparatus for Testing

TABLE 1

Weight of Excrement Removed from 100 Per Cent Mohair Face Frieze Which Had Been Treated with Different Percentages of Mothproofing Agent

% M. P. Agent	*Weight of Excrement* mg.	mg.	*Average* mg.
2	2.1	3.4	2.7
1	2.2	2.3	2.2
0.5	4.9	3.4	4.1
0.25	6.8	7.1	6.9
0.10	13.4	14.2	13.8
Blank	15.4	13.7	14.5

TABLE 2

Weight of Excrement Removed from 51 Per Cent Mohair Face Frieze Which Had Been Treated with Different Percentages of Mothproofing Agent

Frieze A and B 51 per cent Mohair face were different in that the face of A was raised a little higher than B. Other experimental work has shown that regardless of the type of fabric, the graphical representation of damage yields curves of the same general shape.

FABRIC A *% M. P. Agent*	*Weight of Excrement* mg.	mg.	*Average* mg.
2	2.8	1.6	2.2
1	3.3	2.4	2.8
0.5	3.5	4.3	3.9
0.25	7.4	6.9	7.1
0.10	7.4	11.0	9.2
Blank	14.6	15.4	15.0
FABRIC B			
2	3.0	4.1	2.2
1	3.0	2.7	2.8
0.5	5.0	4.0	4.5
0.25	8.4	6.6	7.5
0.1	10.4	14.2	12.3
Blank	19.0	11.4	15.2

to remove the excess solution and placed on a horizontal rack until dry.

TABLE 3

Weight of Excrement Removed from 30 Per Cent Mohair Face Frieze Which Had Been Treated with Different Percentages of Mothproofing Agent

30% MOHAIR FACE FRIEZE

% M. P. Agent	*Weight of Excrement* mg.	mg.	*Average* mg.
2	3.8	1.9	2.8
1	6.0	4.1	5.0
0.5	8.1	7.8	7.9
0.25	9.7	6.7	8.2
0.1	7.4	9.8	8.6
Blank	12.0	12.5	12.3

DATA

Excrement Voided Under Starving Conditions

Larvae were starved in groups of ten without contact with any fabric either treated or untreated, and the excrement was collected until no more was voided. The average weight of excrement voided in this case per ten (10) larvae was one milligram.

These foregoing data (Tables 1, 2 and 3) are plotted on curve sheets 1 and 2. It is interesting to note that the graphs do not give sharp breaks at the point where damage becomes visible that is, at about 0.5 per cent of mothproofing agent.

EFFECT OF STANDARDIZING THE SIZE OF THE LARVAE FOR TESTING

The following data were obtained after more careful methods were used to pick the larvae. In this case, the larvae were picked so that ten (the number used for each test) weighed 50.0 milligrams plus or minus 1.0 milligram.

TABLE 4

Weight of Excrement Removed from 100 Per Cent Mohair Face Cut Pile Which Had Been Treated with Different Percentages of Mothproofing Agent

DATA FOR SECOND SERIES OF TESTS
(Length of tests—4 weeks)
100% Mohair Face Cut Pile

% M. P. Agent	*Weight of Excrement* Milligrams				*Average*
5	3.9	3.9	4.4	3.7	4.0
4	3.8	4.8	4.2	3.8	4.2
3	4.0	4.8	4.4	4.7	4.5
2	4.6	4.6	4.5	4.5	4.6
1	5.3	4.7	6.4	4.6	5.3
0.5	7.6	10.1	11.3	9.0	9.5
Blank	16.3	12.6	13.5	14.3	14.2

These data are represented graphically on curve sheet three.

DISCUSSION

1. Since the amount of excrement is proportional to the amount of damage done by the larvae, we shall calculate the per cent protection of the fabric by the moth-proofing agent as follows:

$$\frac{\text{Weight Excrement Blank—Weight Excrement from treated fabric}}{\text{Weight Excrement Blank}} \times 100 = \text{Per Cent of Protection}$$

TABLE 5
Efficiency of Mothproofing Treatment

FROM TABLE 1

% M. P. Agent	Average Weight Excrement mg.	Corrected Excrement Weight mg.	% Protection mg.
2	2.7	1.7	87.5
1	2.2	1.2	91.2
0.5	4.1	3.1	77.0
0.25	6.9	5.9	56.3
0.10	13.8	12.8	5.2
Blank	14.5	13.5	0.0

FROM TABLE 2 (A)

% M. P. Agent	Average Weight Excrement	Corrected Excrement Weight	% Protection
2	2.2	1.2	91.5
1	2.8	1.8	87.3
0.5	3.9	2.9	79.4
0.25	7.1	6.1	56.5
0.10	9.2	8.2	41.5
Blank	15.0	14.0	0.0

FROM TABLE 2 (B)

2	2.2	1.2	91.6
1	2.8	1.3	87.3
0.5	4.5	3.5	75.3
0.25	7.5	6.5	54.2
0.10	12.3	11.3	20.4
Blank	15.2	14.2	0.0

FROM TABLE 3

2	2.8	1.8	83.8
1	5.0	4.0	64.2
0.5	7.9	6.9	38.4
0.25	8.2	7.2	35.7
0.10	8.6	7.6	32.1
Blank	12.3	11.2	0.0

FROM TABLE 4

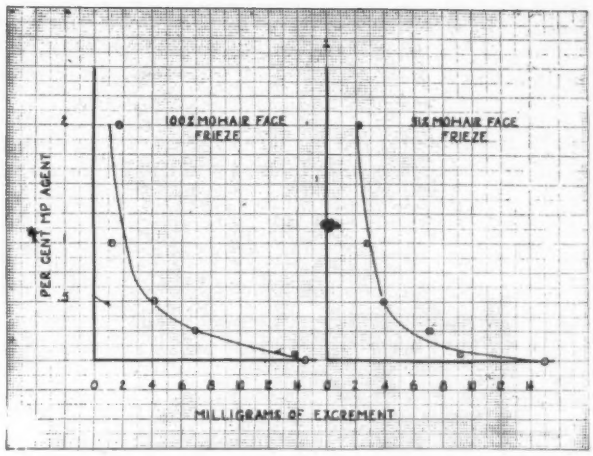
% M. P. Agent	Average Weight Excrement	Corrected Excrement Weight	% Protection
5	4.0	3.0	77.3
4	4.2	3.2	75.7
3	4.5	3.5	73.5
2	4.6	3.6	72.5
1	5.3	4.3	67.3
0.5	9.5	8.5	35.6
Blank	14.2	13.2	0.0

If this method is used to interpret the result of the test, it is readily seen that one will never realize 100 per cent protection. However, this fact is caused by some variables which enter the test which are at present under investigation.

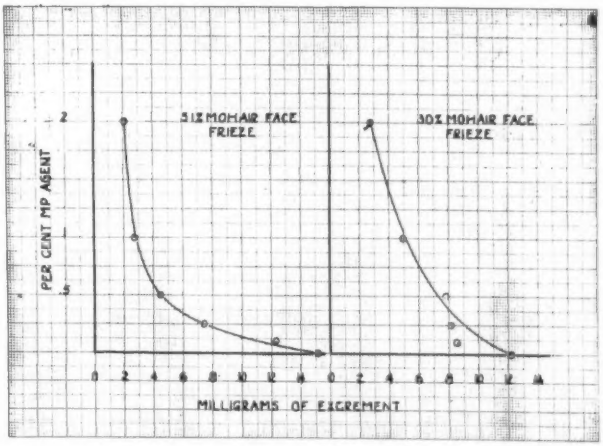
Some of these variables are:

(1) Excrement voided due to cannibalistic activity.

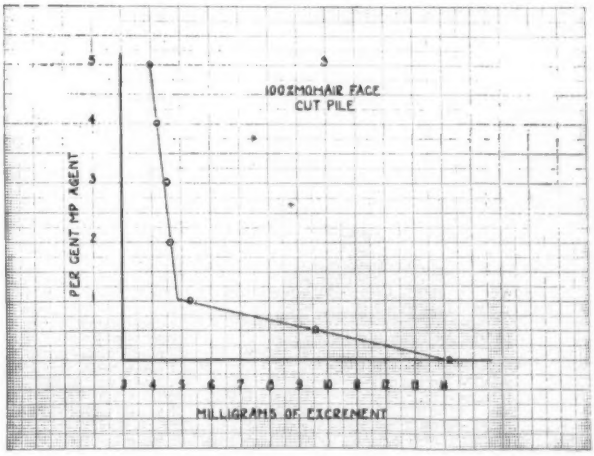
(2) Excrement voided contaminated with undigestible materials such as vegetable fibers (occurs only when the face of the fabric is other than 100 per cent animal fiber.)



Curve Sheet 1



Curve Sheet 2



Curve Sheet 3

A frieze type of fabric containing cotton interwoven with the wool or mohair will show a little extra damage since the larvae remove some of the cotton in the face

along with the animal fiber. This fact is confirmed by microscopic examination of the excrement in which we find the cotton in its original form, that is, undigested.

2. Examination of the fabrics represented by that part of the graph through 5 to about 0.5 per cent mothproofing agent showed almost no visible damage and are therefore mothproof. This fact leads one to believe that the variables mentioned above are reasonable for the excrement formation when little or no damage shows up on the fabric.

3. It was found in some miscellaneous tests that temperature plays an important part in the test. Tests in this work were therefore run at 75° Fahrenheit to prevent error due to varying temperature conditions.

4. When the larvae were of uniform size such as determined by weight, the data agrees much better than when size of larvae is judged by the eye.

5. Work is being done at present in an attempt to shorten the time for a test. Less time for test favors greater accuracy since (1) there is less chance for the larvae to starve to death and (2) less chance for the larvae to change to the pupae stage which happens frequently during the spring months.

6. Although carpet beetle larvae have been used to get the data reported above, the results are given as "mothproof." This has been done since the terms "mothproof" is very loosely used in the trade and generally implies resistance to moth and carpet beetle larvae.

CONCLUSIONS

As a result of the research done and reported above, the test in operation at present is as follows:

(1) area of exposure average 960 square millimeters.
(2) ten larvae are used, weight per 10 equals 50.0 mg. plus or minus one miliigram.
(3) length of time of test—four weeks.
(4) temperature at which tests are run should be constant. 75° Fahrenheit is used since it is the temperature of the average home.
(5) sample is mothproofed if excrement weighs less than six milligrams.

ACKNOWLEDGMENTS

The author wishes to thank the following for their kind co-operation in offering constructive suggestions and criticisms.

C. J. Huber, United States Testing Company.
A. J. Kellner, United States Testing Company.
D. E. Ray, Massachusetts Mohair Plush Company.

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[1]Minaeff, M. G. and Wright, J. H. Ind. Eng. Chem. *21*, 1187-95 (1929).
[2]Back, E. A. Textile World *88*, 56-7 (1938).

The Processing of

Acetate and Viscose Rayon Fabrics

Part III—The Dyeing of Acetate and Viscose Rayon Crepes

C. B. ORDWAY, M.S.

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(Continued from Oct. 3, 1938 issue)

THE acetate dyes are not soluble in the true sense of the word but are prepared in a very fine subdivision or dispersible condition so that to the naked eye they appear similar to other types of dyestuffs that may be classified as being soluble in water or by some chemical action such as in reduction.

Dyestuff manufacturers have improved the dispersing properties of acetate dyes to a marked degree by increasing the minuteness of the dye particle so that many cases of properly prepared acetate dye baths appear similarly soluble as the substantive or acid dye baths.

Due to the insoluble form of acetate dyes, they require the use of various dispersing agents such as sulfonated castor oil, fatty alcoholates, soaps, and other agents to properly disperse them and hold these insoluble particles in the dispersed state throughout the dyeing operation.

These dispersing agents are selected on the following properties desired of a satisfactory dye assistant used in the dyeing of acetate and viscose rayon crepe fabrics.

1. Rapid dispersion of the acetate dyes in powder form so that they can be pasted with the hot solution of a dispersing agent and emulsify them quickly by an addition of hot water satisfactory for straining into dye bath.

2. A. Good stability of the dispersed acetate dye solution as it enters the actual dye bath and is diluted several hundred times.

B. Good stability of the diluted dispersed acetate dye to the action of steam, alkalies and salt (common or Glauber's) over prolonged dyeing operations.

3. Value as dyeing assistants for penetration of fabric. The dispersing agents must possess a certain amount of penetrative value to assist the other dyestuffs used on the goods being well penetrated and should not retard or disturb the dyeing properties of these other dyestuffs.

4. These agents must possess excellent rinsibility in either hard or conditioned (softened by phosphates or zeolite) zero hardness water.

(Continued on page 749)

PROCEEDINGS OF THE

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DECEMBER 12, 1938

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CALENDAR
OF COMING EVENTS

Meeting, New York Section, Chemists' Club, New York, N. Y., January 27, 1939.

Annual Meeting, Inter-Society Color Council, New York, N. Y., Feb. 23, 1939—Details to be announced later.

Nineteenth Annual Meeting and Convention to be held under auspices of Northern New England Section in Boston during 1939. Date and headquarters to be announced later.

COMPLETE
STENOGRAPHIC REPORTS
OF

Technical Papers, Discussions, and Addresses delivered at the Eighteenth Annual Meeting will be published in future issues of the Proceedings.

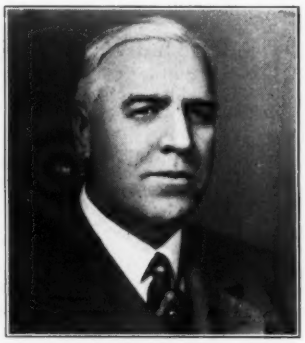
Eighteenth Annual Meeting

AN ENTHUSIASTIC gathering of members and guests were on hand for the Eighteenth Annual Meeting and Convention held on December 2nd and 3rd under the auspices of the Southeastern Section at Atlanta, Georgia, with headquarters at the Atlanta Biltmore Hotel. It was agreed that it was one of the most enjoyable meetings ever held, the arrangements being ably handled in every detail and the program of technical papers being up to the high degree of excellence which has been established at previous meetings.

ALBAN EAVENSON
President

Visitors arriving from other Sections were met at the Peachtree Station and escorted to the hotel, led by the car in which President Eavenson rode.

On Friday a luncheon was held in the Georgian Ball Room of the hotel at which Allen Jones presided. Dr. M. L. Brittain, president of Georgia Tech. welcomed the delegates to Atlanta and the South. A separate luncheon for visiting ladies was held simultaneously which was followed by bridge and other entertainment.



DUNCAN FERGUSON
Vice-President

The luncheon was followed by the first technical session. Complete reports of the papers presented and the discussions which followed will be presented in future issues of the Proceedings. The Annual Business Meeting of the Association followed the conclusion of the first technical session.

WM. R. MOORHOUSE
Treasurer

On Friday evening a buffet supper for members and visiting ladies was held in the Georgian Ball Room. Paul G. Wear presided. A motion picture, "Destiny of Dixie," awarding of various prizes, entertainment by Graham Jackson and dancing followed the supper.

The second technical session opened on Saturday morning and concluded at noon. A luncheon for Sectional officers only followed.

Saturday afternoon was devoted to a complimentary sight-seeing trip which included the Cyclorama of the battle of Atlanta, the Federal Penitentiary and the City of Atlanta itself. Those who preferred took part in a golf tournament, rather than the sight-seeing trip.

ARTHUR R. THOMPSON, JR.
Vice-President

Saturday evening a reception was held at the Atlanta Athletic Club, followed by the Annual Banquet. Robert W. Philip was toastmaster and introduced the persons seated at the speakers' table. Arthur R. Thompson, Jr., presented a past president's pin to Dr. Louis A. Olney, first president of the Association who in turn presented pins to succeeding past presidents, all of whom were present. Prizes for golf and ladies' bridge were awarded. Speakers of the evening included President Alban Eavenson and Senator Walter F. George. In future issues of the REPORTER the remarks of those who spoke at the Annual Banquet will be published. Entertainment was furnished by the Glee Club of Georgia Tech. Following the program of speakers, dancing was enjoyed, concluding the events of the Eighteenth Annual Meeting.

LOUIS A. OLNEY
President Emeritus
Chairman of Research Committee

HAROLD C. CHAPIN
Secretary

An unusual and enjoy-

ROBERT W. PHILIP
Chairman, Southeastern Section
Chairman, General Convention Committee

able feature of the meeting was an exhibit of a wide variety of textile products of the South which were on display in the Georgian Ball Room and lobby of the hotel. A number of cotton mill and rayon companies were represented by exhibits. An interesting contrast in methods of production was shown in the exhibit of the Martha Berry Schools, Inc., of Mount Berry, Ga. In colonial costumes girls busied themselves with spinning wheel and distaff and also sang numerous musical selections. The Berry Schools were started forty years ago by Martha Berry, the daughter of a wealthy plantation owner, as a log cabin Sunday School where she taught Bible stories, cleanliness, decency and kindliness. From this started her plan to help educate the children of Georgia, and later of all the southern states, who would otherwise miss such an opportunity. Today the Berry Schools comprise a number of modern buildings and in the system is Berry College, a full-fledged member of the American Association of Colleges and Universities, a high school for boys, another one for girls, and a community school for boys and girls of younger age, thus carrying on education from first grade through college degree. Since the beginning of the schools ten thousand boys and girls have had an opportunity for education and today, with an annual enrollment of 1,200 pupils, less than eight per cent pay anything in cash for room, board and tuition, working in the school shops, farms, dairies, kitchens, bakeries, weaving room, orchards, poultry lots, brick plant, nurseries or others of the school's twenty-five industries. There is a waiting list of 5,000 each year, said to be the largest of any school in the world. In order to support the schools, gifts are received anuually from persons in all walks of life and all parts of the world.

Among the displays of the rayon producers was shown an acetate rayon blanket and evening dress on a figure. There was also shown, in a modern setting, the steps in rayon production from the raw material to the finished goods. Among the products exhibited by the cotton manufacturers were bags and other containers, bath mats, socks, sheets, shirtings, denims, yarns, under-garments, dress materials, flannels, mattress tickings, upholstery materials, drapery materials, suitings, towelling, bedspreads, etc. There was also an exhibit telling the story of wool manufacture.

CARL Z. DRAVES
Chairman, Technical Program Committee

In the conduct of the annual meeting of the Association the success of the meeting depends upon the program of technical papers arranged for presentation and the handling of the many details of entertainment, transportation, registration, reservation, reception, banquets, publicity, programs, exhibits, souvenirs, etc. Accordingly it is in order to acknowledge the excellent work done by Dr. Carl Z. Draves, chairman of the Technical Program Committee, and Robert W. Philip, chairman of the Local Arrangements Committee, and his corps of committeemen. There is listed below the names of the local committeemen of the Southeastern Section.

It was announced at the annual banquet that the nineteenth annual meeting would be held under the auspices of the Northern New England Section, the date and headquarters to be announced later.

Local Committees—Eighteenth Annual Meeting

Held at Atlanta, Ga., December 2 and 3, 1938, Under Auspices of Southeastern Section

General Convention Committee

Chairman, Robert W. Philip, "Cotton"; Vice-Chairman, Allen Jones, Muscogee Mfg. Co.

Reception Committee

Chairman, J. C. Robertson, R & H Chemicals Dept., duPont Co.; E. A. Feimster, Eagle & Phenix Mills; W. F. Crayton, Dyestuffs Division, duPont Co.; C. M. Stodghill, Stodghill & Co.; Paul B. Seydel, Seydel, Woolley Co.; John F. Nation, J. M. Tull Co.; G. E. Missbach, Mathieson Alkali Works; James S. Bonner, M. Hohenberg Cotton Co.; Hans A. Blum, Paper Makers Chemical Co.; Earl Arthurs, Solvay Sales Co.; Geo. H. Coates.

Reservation and Registration Committee

Chairman, George H. Small, National Oil Products Co.; John W. Ross, Carbide & Carbon Chemicals Corp.; Ralph E. Howell, Frank G. North, Inc.; Lee L. Baker, Detergent Products Corp.; C. G. Stover, Corn Products Sales Co.; R. C. Cochrane, R & H Chemicals Dept., duPont Co.

Banquet Committee

Chairman, A. K. Haynes, Rohm & Haas; R. A. Field, Jr., Newnan Cotton Mills; James I. White, National Aniline & Chemical Co.; M. A. Land, Westinghouse Co.; L. A. Dillon, A. E. Staley Co.; M. T. Johnson, Callaway Mills; W. H. Randolph, Jr., A. E. Staley Co.

Exhibit and Souvenirs Committee

Chairman, W. B. Griffin, Kali Mfg. Co.; J. Hudson Almand, Penick & Ford, Ltd.; Jos. F. Oliver, Stodghill & Co., H. Gillespie Smith, Calco Chemical Co.; Wallace Hamilton; Sam R. Clement, Monsanto Chemical Co.

Publicity and Printing Committee

Chairman, Earle Mauldin, "Textile World"; Richard P. Smith, "Cotton"; E. H. Driver, American Cyanamid Co.; W. L. Johnson, American Moistening Co.; S. I. Parker, Ciba Co., Inc.

Entertainment and Transportation Committee

Chairman, P. G. Wear, Penick & Ford, Ltd.; John C. Turner, Charles Bond Co.; E. M. G. Schroder, General Dyestuff Corp.; James J. Reilly, E. F. Houghton & Co.; C. Russell Gill, Southern Sizing Co; George L. Dozier, Sandoz Chemical Works; Vasser Woolley, Jr., Seydel, Woolley Co.; C. Robert Mitchell, J. E. Rhoads & Sons.

Ladies' Committee

Chairman, Mrs. James Ivey White; Mrs. Sam R. Clement, Mrs. C. Russell Gill, Mrs. A. Kempton Haynes, Mrs. W. H. Randolph, Jr., Mrs. W. H. Randolph, III, Mrs. George H. Small, Mrs. John C. Turner, Mrs. Paul G. Wear, Mrs. William B. Griffin.

Textile Waste Studies

in North Carolina*

HENRY J. MILES and RALPH PORGES**

THE disposal of large quantities of liquid textile trade wastes is a vital problem wherever there occurs a concentration of textile industries. Before the development of large manufacturing districts trade wastes were discharged into streams which were well able to handle them. The question then arises, "Why is it now objectionable to discharge untreated trade wastes into streams?"

There are several characteristics of textile liquid wastes which make this method of disposal objectionable, namely:

1. They may contain substances requiring oxygen for stabilization.
2. They may contain substances toxic to fish and other forms of stream life.
3. They may have a very high or very low pH.
4. They may be highly colored.
5. They may be odorous.

It can easily be seen why color and odor would be objectionable, but to understand why all these characteristics would make it undesirable to dump these wastes untreated into a stream it is necessary that the reader be familiar with the sanitary engineer's conception of a stream as not merely a body of water but a chemical and biological treatment plant with a limited capacity. To understand the limitations of a stream as a treatment plant, the nature of the purifying agents it contains must be considered.

A stream is a living community whose inhabitants range in size from fish and other aquatic forms down to microscopic plants, animals, and bacteria. Most of these inhabitants require oxygen for their life processes and obtain it from the dissolved oxygen present in the water. The amount of dissolved oxygen normally present in an unpolluted stream depends mainly on the temperature of the water and the rate of reaeration or absorption of oxygen from the atmosphere. As long as the normal aquatic life prevails in a stream it has the ability to dispose of limited amounts of wastes which may be dumped into it by the simple process of utilizing them as food for its various inhabitants. As the volume of waste increases, the aquatic life is affected in several ways.

The waste may react chemically with the oxygen in the stream, thereby depleting it and causing the death of some forms of stream life.

If the waste is toxic, it will kill off certain forms of the aquatic organisms.

If the waste is not toxic but on the contrary good food material for certain types of stream life, it may still cause trouble by excessively stimulating their growth, thereby using up more of the limited supply of oxygen available. If added in larger amounts than the organisms can utilize, it may accumulate.

If the waste causes the stream to become colored or turbid, sunlight is shut out and the green aquatic plants, dependent on sunlight for growth, die off. As these plants give off oxygen to the water as part of their life activity, their absence decreases the available dissolved oxygen supply. The main objection of color, however, is that it may give a stream the appearance of being more polluted than it really is and arouse the objections of the people living in the region through which it flows. The removal of color is one of the major problems of waste disposal.

Deoxygenation and reaeration combine in a stream to yield a curve characteristic of self-purification and known as the dissolved oxygen sag (Fig. 1). It is evident that

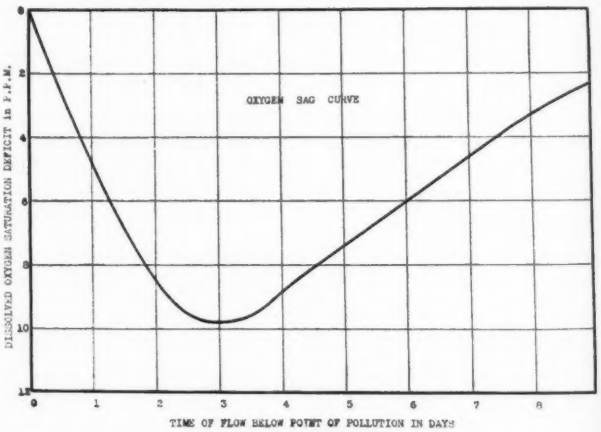


Fig. 1—Oxygen Sag Curve

as soon as a waste is discharged into a stream, the dissolved oxygen is rapidly diminished. If the low point of the curve is above 40 per cent saturation, harmful effects may not occur. When the curve drops below that point most fish will die and when all the oxygen is used up septic conditions arise. Anaerobic bacteria, that is, those forms which thrive in the absence of dissolved oxygen, prevail and by their life processes produce hydrogen sulphide gas from

*Presented at meeting, Piedmont Section, May 7, 1938.

**Special and Assistant Investigators of the Textile Foundation, Washington, D. C.

the wastes. In this putrescent condition a stream no longer performs its work of self-purification.

The logical conclusion is to remove enough of the polluting substances from the wastes so that the receiving body of water can successfully carry on its portion of purification. This is the function of the disposal plant.

METHODS OF TREATING TEXTILE WASTES

Since considerable textile waste is discharged untreated into municipal sewerage systems, various experimental units have been operated endeavoring to handle both wastes alone and mixtures of sewage and waste. On wastes alone, chemical precipitation has been used, and on mixtures of sewage and waste, chemical precipitation, biological and mechanical filtration, and the activated sludge process.

In the chemical precipitation method, chemicals are added which produce a precipitate or floc that settles through the liquid, sweeping out the suspended and colloidal matter. Under biological filtration are included the sprinkling or trickling filter in which the waste mixture is passed through a filter of broken stone, and the bio-filter in which the waste mixture is recirculated through a similar unit. These filters attempt to duplicate the natural purification processes which take place in a stream as the water tumbles over the rocks and obstructions in the stream bed. The tumbling action of the water assists in maintaining in the stream the oxygen so necessary for the existence of fish and other aquatic plant and animal life. The stones serve as a base for the films of microscopic plants and animals which absorb impurities from the passing water and utilize them for food, thereby changing them into less complex and more stable substances. Under mechanical filtration may be mentioned the sand filter, since in treating textile wastes it is very often used in conjunction with other processes to remove finely divided suspended matter. The activated sludge process consists of blowing air through the sewage-waste mixture, thereby stimulating the growth of various bacteria and other organisms which break down the complex compounds of the mixture into simpler and more stable forms. After a period of aeration of from four to nine hours the mixture is run into settling tanks and kept there for about two hours to allow the suspended matter and most of the organisms to settle out, leaving a clear and purified supernatant liquid. This liquid is discharged into a stream or other body of water and a portion of the settled material or sludge is pumped back into the aeration tank and used over again. Because this return sludge is active with the purifying organisms, the process is termed the activated sludge process.

SUMMARY OF OTHER WORK

Chrisco, White, and Baity[1] experimenting on 29 wastes obtained from the Proximity Manufacturing Company, the Proximity Print Works, and White Oak Mills of Greensboro, North Carolina, and the Durham Hosiery Mills of Durham, North Carolina, found that "in general it seems that the re-agents copperas and lime together form the most satisfactory treating material from a standpoint of color removal. . . . Wastes from sulfur dyes are notoriously difficult to treat. . . . The most effective re-agents for clarifying sulfur wastes seem to be strong acids. . . . This treatment produces a highly acid, milky effluent. . . . Complete clarification can be accomplished only at unwarranted expense." Another waste that offered trouble in chemical treatment was kier liquor. To quote from the same paper: "Using large amounts of chemicals, kier liquor can be cleared by this procedure, although such a process would be prohibitively expensive."

Campbell[2], working on color-shop wastes at the Proximity Print Works of Greensboro, found that lime is the best and most economical coagulant for the treatment.

Rudolfs and Baumgartner[3], using sulfur dye waste obtained from the Proximity Manufacturing Company of Greensboro, found that ferric chloride and hydrochloric acid gave the best results. Second choice was ferrous sulfate and sulfuric acid. Because of slow settling, sand filtration was recommended. To quote from their paper: "The amount of chemicals and subsequently the cost of complete clarification accompanied by rapid settling is rather high."

Work performed at Durham[4] showed that combined wastes could be successfully treated at low rates by the activated sludge and trickling filter processes, activated sludge being the most suitable method. "Two wastes seriously affected experimental treatment of the combined wastes; these wastes are the concentrated kier liquors and sulfur black dye liquors."

Campbell[5], handling wastes from White Oak Mill and Proximity Print Works, Greensboro, recommended calcium chloride for indigo wash waters although ferrous sulfate and lime also gave results that were satisfactory. No satisfactory method for the chemical precipitation of sulfur dye was developed. Using bio-filtration on mixtures of sewage and kier liquor, and sewage and sulfur dye, promising results were obtained.

From this summary of past experimentation, it is seen that it is expensive to treat textile wastes chemically and that biological methods show promise.

Geyer and Perry[6], after a thorough study in this country and abroad of present methods of treating textile wastes, suggested among others the following research problems:

A study of direct oxidation by air, ozone, or bleaching agents.

A study of the application of biological treatment methods for the purification of textile wastes.

A study of biological purification of mixtures of domestic sewage and textile wastes.

A study of methods of treating sulfur dye wastes.

In accordance with these suggestions, we have conducted experiments on the treatment of black sulfur dye and other wastes by aeration and the activated sludge process and

are at present working on the treatment of waste by bio-filtration and chemical precipitation.

DESCRIPTION OF TEXTILE FOUNDATION EXPERIMENTAL PLANT AND LABORATORY, GREENSBORO, NORTH CAROLINA[7]

The experimental plant in which these experiments were conducted is located on the property of the Proximity Print Works of Greensboro, North Carolina. It consists of a covered platform, an open platform, and an adjoining laboratory (Fig. 2).

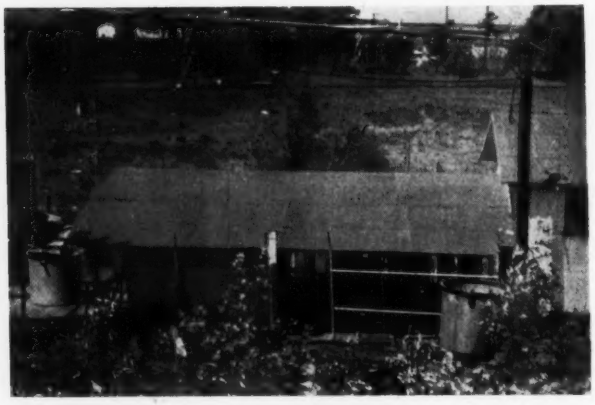


Fig. 2—Textile Foundation Experimental Plant and Research Laboratory at Greensboro, N. C.

On the covered platform are mounted the various units of the activated sludge plant as shown in the general layout (Fig. 3). All tanks are made of heavy sheet iron and include essentially the following units:

A 240 gallon circular mixing tank (Fig. 4, foreground).

A 210 gallon circular primary settling tank (Fig 4, center).

A 720 gallon rectangular aeration tank (Fig. 4, rear).

Seven small aeration tanks (Fig. 5) each of 40 gallon capacity and equipped with swinging syphon outlet pipes mounted on one side. Compressed air is supplied through small sections of four inch diameter diffuser tubes mounted at the ends of one half inch diameter pipes. (Two such units are shown in Fig. 4 leaning against the mixing tank.) Air is admitted to the units from a common header mounted above the tanks through individual meters of the orifice type.

The compressed air was supplied by a Nash Hytor compressor, pressure being regulated by wasting the excess air.

The general piping layout is shown in Fig. 3. Sewage was pumped to the plant from a nearby main outfall sewer of the northern section of the City of Greensboro. At the plant it could be piped to the mixing, settling, or large aeration tank. From the mixing tank it could be pumped into any of the small aeration tanks. The aeration tanks are equipped with syphons to permit the withdrawal of the contents from any level.

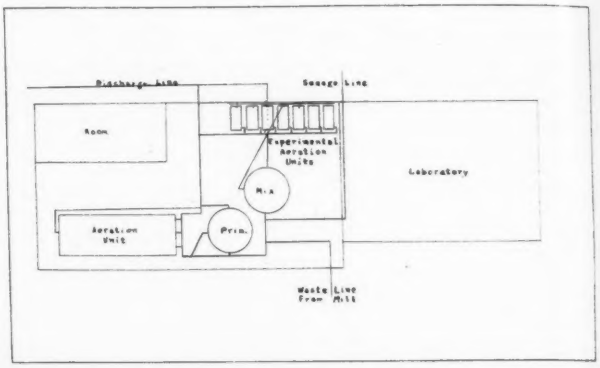


Fig. 3—General Layout of Plant

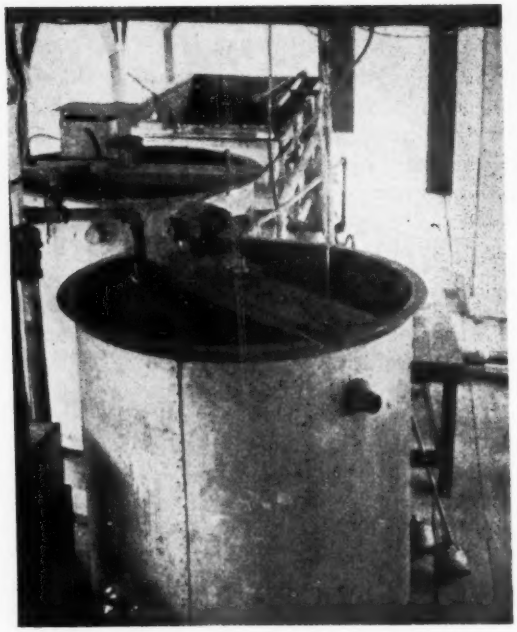


Fig. 4—Mixing, Primary Settling and Large Aeration Tanks.

On the open platform are mounted the various units of the bio-filtration plant as shown in Fig. 6 and consist of the following:

A bio-filter consisting of two heavy sheet iron drums, open at each end, 4 ft. 7 in. in diameter and each 4 ft. 6 in. long, standing on end, one on top of the other and separated by a shallow metal pan 5 ft. 7 in. in diameter in which is placed a wooden grill. The grill permits ventilation and serves as a support for the 1½ inch and 2 inch broken stone with which the upper drum is filled to a depth of 4 ft. On top of the stone rests another shallow pan, slightly smaller in diameter than the filter, and having a perforated bottom. The mixture to be filtered is pumped onto the top of the filter, distributed uniformly over the surface of the stone by the distributor pan, allowed to percolate down through the filter and is collected at the bottom of the stone-filled section by the effluent pan from which

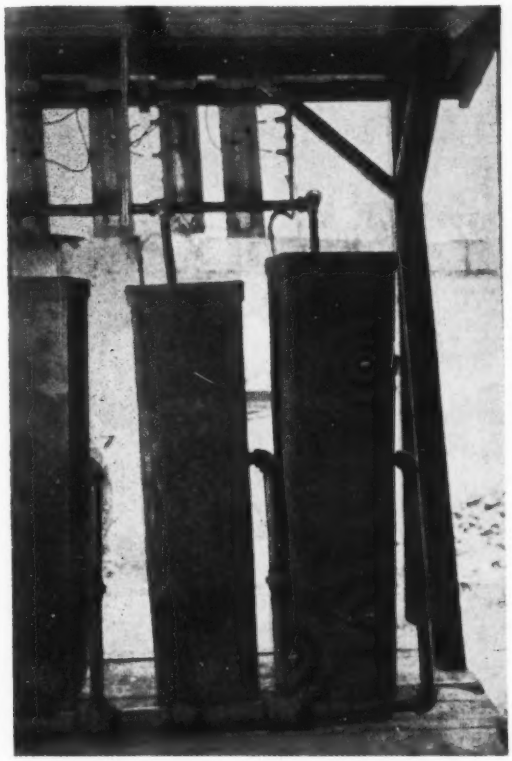


Fig. 5—Small Aeration Tanks

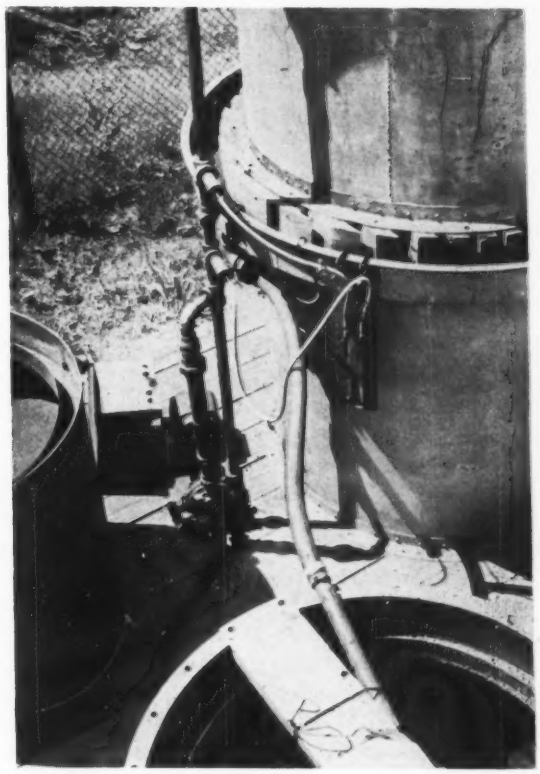


Fig. 6—Detail of Recirculation Filter

it is piped by gravity to the detention tanks. A vertical sheet iron waterproof partition divides the distributor pan, filter, and effluent pan into two sections of equal volume which can be operated as two distinct filters.

Two 210 gallon detention tanks having two bottom outlets each, one leading to a pump and the other to a drain.

Two 1½ inch centrifugal pumps for pumping the waste liquid from the detention tanks to the top of each side of the filter. The rates of flow are measured by orifice meters and can be regulated by valves.

The bio-filter is designed on the basis that a rate of application of one half gallon per minute on each half of the filter is equivalent to a rate of four million gallons per acre of filter area per day.

In operation, a given volume of sewage is pumped to the detention tank where the textile waste is added and thoroughly mixed by means of a paddle. The mixture is then recirculated through the filter by the centrifugal pump until the desired purification is obtained.

The sewage used in these experiments was of a weak domestic type, but occasional large variations of the strength indicated that some industrial waste might have been present.

The sulfur dye wastes from the mill were kept in a large storage tank with a floating cover from which they could be drained to the plant as needed. The waste was obtained from the jigs and was undiluted by wash water.

PROCEDURE

One of the important factors controlling the purification obtained by the activated sludge process is the amount of activated sludge, as measured by suspended solids, carried in the aeration tanks. The authors performed a series of experiments made simultaneously in four identical aeration tanks containing different amounts of suspended solids but supplied with equal amounts of air throughout equal aeration periods. The suspended solids varied from 500 to 3500 parts per million and the amount of air used was the least that would keep the solids in suspension, 3.86 cubic feet per gallon of aerating mixture per nine hour aeration period.

In practice, activated sludge plants are usually designed to operate on a continuous process, the settled sludge from the sedimentation tanks being returned continuously to the aeration tanks. In our experimental plant, however, we operated on the batch process so as to secure more accurate control of the process and obtain the required information more easily.

Sewage was pumped into the mixing tank, the required volume of dye added, the whole batch mixed for fifteen minutes, and finally pumped to the small aeration tanks

containing the activated sludge. The mixtures in the small tanks were aerated for nine hours, after which the air was turned off and the solids allowed to settle for nine hours. The purified supernatant liquid was then withdrawn through the swinging syphons and replaced with fresh sewage-dye mixture. This procedure was repeated without interruption for a period of three months using gradually increasing quantities of dye. When the amount of suspended matter, activated sludge, in the aeration tanks exceeded the desired concentrations, some was withdrawn. At no time was it found necessary to withdraw sludge from the tank containing 3500 parts per million of sludge.

TESTS

As the methods of treatment must be chosen for their ability to remove the objectionable characteristics of the wastes, the control tests must be such that they will measure these objectionable features. All analyses were performed according to "Standard Methods of Water and Sewage Analysis" except where modifications were necessary to allow for the color of the dye waste. Among the tests made were the following:

Biochemical oxygen demand, commonly known as B.O.D. The B.O.D. of a waste is the amount of oxygen in parts per million by weight required to stabilize the decomposable organic matter by aerobic biological action. (300 p.p.m. sodium bicarbonate dilution water was used and samples incubated for 5 days at 20° C.) From the nature of this test it is readily seen that as it measures the activity of the organisms caused by the pollutional load of the waste, it is the most significant and reliable of present day analyses.

Dissolved oxygen, commonly known as D.O. Large samples were allowed to settle for ten minutes and the supernatant liquid used in this test. (The permanganate Rideal-Stewart modification of the Winkler method was used in all cases.) This test is important in biological processes for reasons already stated.

pH. The supernatant liquid of settled or centrifuged samples was tested with the usual color standards after parallel tests with a quinhydrone electrode showed that errors caused by color of the dye were negligible. Wastes discharged into streams should be as near neutral as possible with limiting pH values of 8.0 and 6.0.

Color. In the experiments conducted by the authors it was necessary to devise some standards of our own because of the intense blue-black color of sulfur dye waste. The waste was arbitrarily assumed to have a color of 10,000 and portions were diluted with tap water until color intensities were obtained which could be compared with the samples to be tested. For purposes of comparison, the color standards as used are approximately ten times the intensity of the platinum-cobalt standards; that is, a color recorded as 10 approximates the 100 color standard of the platinum-cobalt scale. All color and other analyses were made on the effluent after one half hour settling.

RESULTS

The purification obtained as measured by B.O.D., turbidity, suspended solids, and color removal for different mixtures of sewage and dye wastes are given in Figures 7 to 10 inclusive.

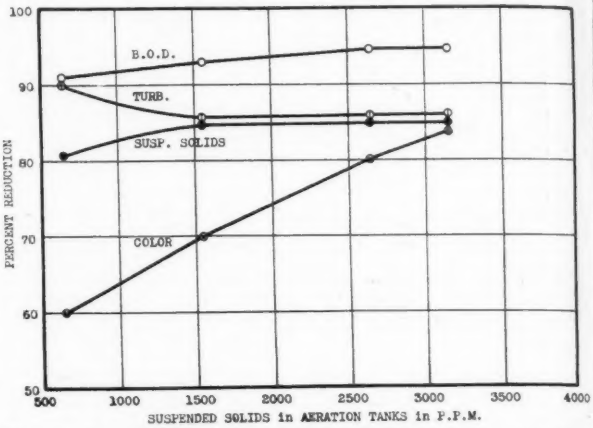


Fig. 7—Curves Showing Purification Obtained in Aeration Tanks Containing Various Amounts of Suspended Solids and Treating One-Half Per Cent Dye Waste.

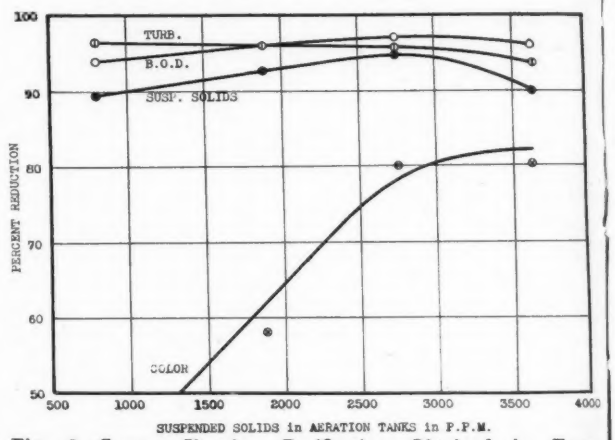


Fig. 8—Curves Showing Purification Obtained in Four Aeration Tanks Containing Various Amounts of Suspended Solids and Treating One Per Cent Dye Waste.

DISCUSSION

The amount of suspended solids maintained in the aeration tanks appeared to affect the B.O.D. and suspended solids reduction very slightly. There was a slight indication that different amounts of suspended solids were optimum for different concentrations of dye wastes. The best turbidity removal took place in those tanks having the least amount of suspended solids.

The greatest color removal was obtained in that tank having the highest suspended solids concentration. This is clearly shown in Figures 7 to 10 inclusive in which the color removed expressed as a percentage of the color of the sewage-dye mixture added to the tanks is plotted against

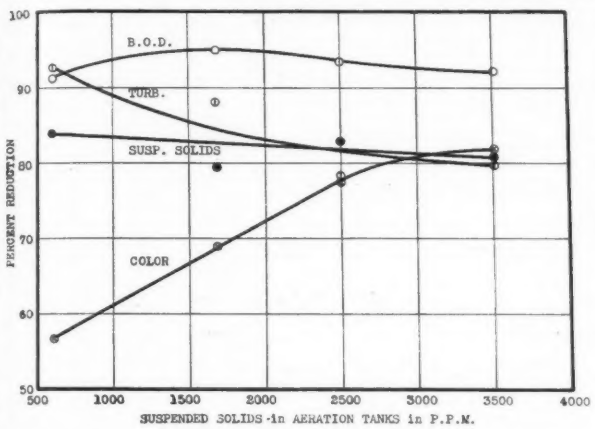


Fig. 9—Curves Showing Purification Obtained in Four Aeration Tanks Containing Varying Amounts of Suspended Solids and Treating One and One-Half Per Cent Dye Waste.

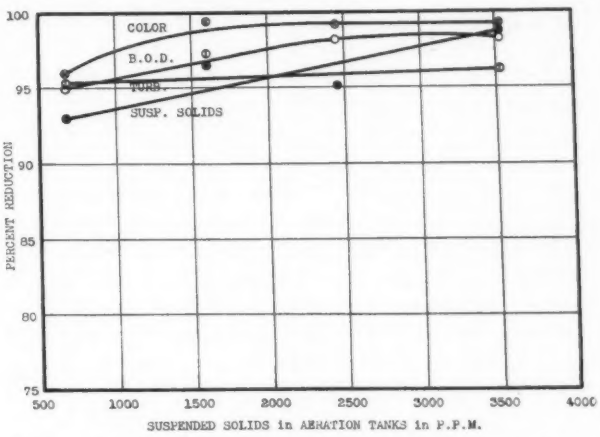


Fig. 10—Curves Showing Purification Obtained in Four Aeration Tanks Containing Various Amounts of Suspended Solids and Treating Original Dye.

the average suspended solids concentration maintained during the group of runs. The effluents from tank 4 (3500 p.p.m. solids) and often from tank 3 (2500 p.p.m. solids) were practically colorless.

It is interesting to note the high color removals recorded in Fig. 10. In this set of runs the original dye mixture as purchased by the Mills was used instead of the spent wastes discharged at the end of the process.

The pigment once separated from the solution is apparently acted upon by the organisms, as no evidence could be found of an excessive accumulation of dye in any of the tanks. This is of particular interest in tank four containing the greatest amount of suspended solids and producing the best color removal, as in this tank no sludge was removed at any time throughout the entire three months period of operation. At the end of the experiment, sewage without dye was added to the sludge in the aeration tanks. It was converted into an absolutely clear and colorless liquid of very low B.O.D., showing that whatever color the sludge might have contained was not easily separated from it and did not inhibit its purification properties.

That the color is initially removed by adsorption by the sludge may be indicated by the removal of as high as 50 per cent of the color during the first 15 minutes of aeration, the highest removals being in the tanks with the highest suspended solids concentrations.

Aeration of Dye Alone.—For purposes of comparison, the dye waste as dumped from the jigs at the end of the dyeing process was aerated continuously for 48 hours without sewage or sludge. At the end of this time there was no evidence of any purification having been accomplished.

Preliminary Treatment.—It is important that the wastes from the Mills be discharged into the sewers in proportion to the flow of domestic sewage. Our experience with strongly alkaline wastes such as sulfur dye proved that sudden changes in the volume of wastes added to the aeration tanks caused very high initial pH values and low pH values at the end of the process. This probably led to the difficulties experienced in previous investigations in which the sludge refused to settle after aeration. As high as 40 per cent of the color was removed from the dye by mixing with raw sewage for 15 minutes. This does not include the reduction in color by dilution. The results given in Figures 7 to 10, inclusive, on color removal do not include this initial color removal in the mixing tank. In a municipal sewerage system a large proportion of the color should be removed from the waste by mixing with the sewage in the sewers before reaching the treatment plant.

Amount of Sulfur Dye Waste Which Can Be Treated With Sewage by the Activated Sludge Process.—The dye wastes which we treated were the undiluted waste from the dyeing jigs. We have been able to handle sewage containing as high as three per cent of this waste and there are no indications that we have reached the upper limit. If this waste were led into equalizing tanks before being discharged into the city sewers, it would be diluted about 130 times by the rinse waters, or, in other words, the dye waste is 0.8 per cent of the total volume of waste discharged from the jigs. Assuming that the first rinse waters are almost as highly concentrated as the spent dye bath, the resulting strength of the mixture would still be within the concentrations we have handled. These results emphasize the importance of each mill building equalizing or holding tanks into which all wastes and rinse waters are discharged and which are in turn emptied into the city sewers by means of an automatic valve in proportion to the sewage flow.

TREATMENT OF SEWAGE-DYE MIXTURES WITH THE BIO-FILTER

The Bio-Filter has been operated for two months on the batch process with various volumes of sewage-sulfur dye mixtures and at various rates of recirculation ranging from

3 to 150 million gallons per acre of filter surface area per day. The indications so far are as follows:

The most important factor is time. Regardless of how fast the sewage-dye mixture is recirculated at least one hour must be allowed for purification under optimum conditions.

The lower the rate of application of sewage-dye mixture to the filter, the more efficient is the purification obtained.

Using a 30 gallon mixure of sewage containing one per cent dye and a rate of recirculation of 0.75 gallons per minute equivalent to a rate of application on the filter of 3 million gallons per acre per day, a removal of 90 per cent B.O.D. and 70 per cent color was obtained in two hours of recirculation.

SUMMARY

The treatment of sulfur dye waste mixed with domestic sewage by the activated sludge process was studied on a semi-plant scale by the batch process over a period of three months.

Four identical aeration tanks containing approximately 500, 1500, 2500, and 3500 p.p.m. suspended solids were operated in parallel using 9 hour aeration periods and 3.86 cu. ft. of air per gallon of aerating mixture.

The B.O.D. and suspended solids reductions were practically the same in all the tanks. The color removal was greatest in the tank containing the most suspended solids. With proper control it was possible to obtain a clear sparkling effluent having a B.O.D. of less than 15 p.p.m.

No evidence could be found of an excessive accumulation of dye in any of the tanks.

As high as three per cent of the concentrated waste was successfully treated, which is considerably above the concentration which will be obtained in the local municipal sewage if the large volumes of rinse water used in the dyeing process is included.

It is most important that the dye wastes and rinse waters be mixed in equalizing tanks before discharging into the city sewers in proportion to the sewage flow.

The length of aeration period and rate of air consumption used in these experiments were selected mainly for convenience in our experimental plant and should not be considered the minimum values in the treatment of sulfur dye wastes.

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Textile Tides*

K. H. BARNARD

WE ALL find ourselves a bit at sea during these times when even the good ship of state itself is meeting bad weather. The average textile chemist is like the skipper of a small boat, beating to windward against the head winds of poor business, seized by the tide rips of shifting demands and fashions: blinded by the fogs of political uncertainties and worried by the rocks and shoals of wage cuts and curtailed operations. This poor sailor to whom I refer is of course a cotton or rayon textile chemist. One never makes canvas out of wool and I will not attempt to speak for the wool chemists. With this gloomy outlook ahead of the textile mariner, what course can he set to get clear of his difficulties? My suggestion is to plot some of the tides we have all seen ebb and flow in the past and by allowing for them we may reach a safe anchorage on that distant shore which is at present far over the horizon.

The first tide and the one which will affect most strongly the personal fortunes of every textile man is that ebb and flow in the use of the various textile fibers:—silk, wool, cotton and synthetic rayons. These are constantly rising and falling like a troubled sea. Here are a few figures on them: Of the 4,000 million pounds of textile fibers used annually in this country, 80 odd per cent—or 3,500 million pounds—are cotton. Over the last 15 years the fluctuations in the total use of cotton have been relatively slight. For the textile sailor, cotton represents deep water—out of soundings—plenty of room to maneuver—a safe voyage. Wool takes 300 to 400 million lbs. a year, about 10 per cent of cotton on a poundage basis, though nearer 50 per cent of money value. Between 1923 and 1934 wool showed a strong ebb tide followed by a rapid rise in 1935 and 1936. My guess for 1937 and 1938 is that the tide has turned back again and is going out. Silk is roughly 10 per cent of the poundage of wool or 1 per cent of cotton, and the last 10 years have shown a steadily decreasing volume. The silk sailor is in restricted waters,

*Presented before Northern New England Section, May 6, 1938.

compared either with cotton or wool and if the tide does not turn back soon for him, he is likely to be left high and dry on a bar. However, the tide to which I want to direct your attention especially, is rayon. Twenty years ago it hardly existed. Since 1920 it has kept doubling its production every three or four years so that it soon passed silk and is now about to take the weather berth on wool and set sail after cotton. Its strong position in this country is even stronger abroad, particularly in Germany and Italy. Take a look at Japan, a country which produces 85 per cent of all the world's silk. It would be natural for them to devote themselves to a monopoly on silk, but instead of that, they are smart enough to be working feverishly on rayon and lead the world in its production, making 50 per cent more rayon last year than we did in this country with all our great resources and technical ability. Rayon was a test tube baby, fathered by chemists and mothered by research and today in textiles represents not a tide, but a *tidal wave*.

The next tide or trend is that fickle one of style. Take the question of women's dress. Twenty-five years ago she wore a half a dozen petticoats—six to twenty yards of cotton in those days; gone with the wind today. Why the sweet young things may not even have a skirt itself today and the names of her garments give any textile man a sinking feeling. "Shorts" and "skanties" to list only a couple of them. And where are the ginghams of yesterday that kept the wolf from the door in many a New England town. Look at the Everett Mills in Lawrence or the great Lancaster Mills in Clinton, if you want to see how the fickle winds of fashion can leave a good ship rotting out her timbers. What has happened once can happen again and it certainly will pay us to watch out for the first signs of a cloudburst before it blots out the sun, moon and stars of our finances.

The third and last tide or trend that I want to touch upon is the one towards greater permanency. Of course Eve did not care in the Garden of Eden if her clothes wore out. She could get another outfit from the next fig tree, but the modern Eve is certainly becoming permanently minded. She wants colors that will not fade or crock, clothes that will not stretch or shrink, suits that resist wear and finishes that last as long as the life of the garment. Consumers are becoming vocal in their demands for information regarding what they wear. What is it made of? How will it wash? What is its serviceability? My own line of work has a lot to do with permanent finishes and you can put it down in your log book that the ordinary starch finish on cottons and rayons is on its way to Davy Jones' locker. Synthetic resins give superior results not only in hand and other characteristics such as reduced shrinkage, added strength, etc., but also have the ability to stick to the fabric through the wash tub or dry cleaner's establishment. The finish is permanently fastened to the cloth.

Perhaps a word or two about these finishes might not be amiss. By far the greatest type from a volume standpoint are the urea formaldehyde resins. In a clear limpid solution they penetrate the yarns and give resiliency and as such are used to anti-crease fabrics according to the Tootal, Lee patents. If polymerized further, they give surface rather than penetrative coatings and when applied to cloth may give a heavier hand or a mirror-like luster, as on the glazed chintz. While particularly fast to dry cleaning, these urea resins are not the fastest type to washing. Where greater washing fastness is required we have the glyptals, a condensation product of phthalic anhydride and a drying oil. An entirely different approach to the problem of permanent finishes is found by dissolving cellulose itself, for example, by partially dissolving a voile or lawn we get a clear sheer effect, with added stiffness where the crossing threads are actually fused together. This can be accomplished with cuprammonium or with Triton B—trimethyl benzyl ammonium hydroxide. Instead of attacking the fabric we can build it up by coating it with a precipitated layer of cellulose from either of these solvents previously saturated with cellulose. What we are doing is coating the fabric with a layer of regenerated rayon. This is generally a soft dull finish so that by regulating the amount of cellulose dissolved in the solvent, we can get any gradation of finish from a hard, clear, glassy effect with no added cellulose to a soft dull finish where the maximum amount of cellulose is used in a saturated solvent. A still different type of permanent finish lies in the use of cellulose ethers. Some of these are alkali soluble and are, therefore, applied in caustic solutions and the cellulose ether precipitated either by heat or acid on the cloth. Other cellulose ethers are only soluble in organic solvents and are precipitated out of their solutions by evaporating the solvent. Some of these, like ethyl cellulose, have the property of being thermoplastic which is of interest to cotton finishes in that it permits the housewife to reproduce the original finish by merely ironing the goods with a very hot iron, thus getting back the original luster and stiffness. There are so many types of finish and so many possibilities of recombining and modifying them that their variety is infinite. Thus almost any characteristic which a customer may desire, can now be obtained, providing the customer can pay the price and the textile chemist has the skill to combine some of the incompatibles.

However, to get back to our textile sailor, most of us are so buffetted by our daily troubles that we rarely pause to take a long look ahead and estimate our position for tomorrow—or next month—or next year! My suggestion is merely the old trite one, that a man cannot get very far off the course if he sets it by the steady north star of lower costs and better quality. If we lack the vision to see this, I am afraid we shall find ourselves—to conclude my nautical simile—"Spurlos Verzenkt."

Newer Textile Agents

in Dyeing and Finishing of Textile Fabrics*

LLOYD O. KOONS

THE principle objective of this paper is to acquaint you gentlemen with some of the facts concerning the newer textile agents, their effects, compatibility and applications.

It is significant that at the present time manufacturers are utilizing an ever increasing range of complex chemical substances such as sulfated aliphatic alcohols, fatty acid condensation products, alkyl-naphthalene sulfonic acids, protein protective colloids and protein-fatty acid products. It is almost impossible to keep track of them all, and to study their possible uses in connection with the textile and related industries. Scattered information from many sources has been gathered in an effort to present definite statements on the nature of these products and properties of their solutions, and on the uses for which they are claimed to be suitable.

The dyer or finisher should consult the manufacturer for specific uses and limitations of any of these newer materials, otherwise he may encounter trouble, and obtain disappointing results, which are caused by their incompatibility with other processing agents, which might be present in the bath, or in or on the fiber. Some of the newer textile agents are grouped together and classified as surface active agents.

The action of these consists essentially in reducing surface tension, and in dissolving the fatty film covering the surface of the fiber. Both actions are simultaneous.

These agents in general have some or all of the following properties: wetting-out, dispersing, emulsifying, penetrating, detergency, and excellent softening properties. Some also possess great stability to strong acids and alkalies, and combine with inorganic salts to form soluble salts.

There are still other valuable properties, they penetrate and collect upon the surface of the fibers and are firmly fixed, forming complex combinations with the dyestuffs, which result in increasing their fastness to washing. Some are also absorbed and held tenaciously by the fiber. The amount absorbed varies considerably with different products.

They find application in the scouring of wool stock, yarns and fabrics, and their use in this connection results in a clean, lofty material, with a characteristic and desirable hand. Similarly, they can be employed alone or in conjunction with other detergents in scouring cotton, rayon and wool, etc. As wetting agents, they are also used in desizing, bleaching baths and mercerizing solutions. As dyeing assistants, they act as dispersing, leveling, wetting and penetrating agents. With some dyestuffs, they exhibit a retarding action, producing more uniform and level dyeings. Among the various applications of this nature in which they are employed are included package-dyeing, particularly of hard-twist yarns, dyeing of hosiery to obtain better penetration of seams and heels, dyeing of union materials to aid matching of shades.

The dyer should use discretion when selecting these products for specific uses. They sometimes will not yield correct results. Temperature, pH and the presence of other materials in the solution may have important effects, and should be considered. This is especially true in the finishing of silk hosiery. Much of the silk hosiery manufactured today is treated with water repellent and delustering compounds. Some of these surface active agents, when used in the finishing bath with water repellent and delustering compounds, are not compatible, and consequently the delustering and water repellent properties are impaired. Some also impart a soft, raggy, handle to silk, which is undesirable. This property is more desirable in the finishing of rayon, cotton and woolen fabrics.

The present day requirement in silk hosiery finishing is to produce a finish which has a subdued luster, high degree of repellency, and also a certain amount of firmness, so that the hosiery will retain its shape, and keep this property indefinitely on storage.

There are also some amine derivatives which have outstanding softening properties, but are not compatible with alkalis, soaps, sulfonated oils, and sulfate ions, with which chemicals they form complex combinations, insoluble in water, causing a deposit of nigger heads and oil spots on the fabric, which are always troublesome and sometimes very difficult to remove.

It can readily be seen that products of this nature should be carefully selected, especially when applied to silk, for the purpose of soaking and softening for throwing in the manufacture of silk hosiery, which subsequently is to be dyed and degummed in an alkaline bath, in the presence of sodium sulfate.

The statements that I have just made do not sound very encouraging for these newer textile agents, but the contrary is quite true. When they are used for the specific purposes for which they are intended they produce excellent results, in many cases superior to the ordinary sulfonated oils. For instance, they give excellent results in the scouring and dyeing of woolen fabrics.

*Presented at meeting, Mid-West Section, October 8, 1938.

In the scouring of wool they act as excellent emulsifiers of the extraneous matter present in the wool, and keep the spinning oils in suspension. If the oil were removed from the fiber without being emulsified, it would collect on the top of the bath. Some of the oil would then be redeposited on the fiber when it was taken out of the bath. They also form soluble, complex salts with calcium and magnesium, which are always present in raw wool, thereby preventing the formation of insoluble calcium and magnesium soaps.

In the dyeing of woolen materials they are sometimes incorporated in the dye bath, and act as protective colloids. It is well known that sulfuric acid and chrome have a harshening effect on wool, but when these agents are present their protective action minimizes the harshening effect, and the softening properties impart a soft natural handle, with plenty of elasticity and resiliency.

There are other agents which are known as protein decomposition products, which minimize the action of alkalies on silk and wool. They are recommended to be used when difficulty is experienced in matching a shade, which necessitates running the goods a long time; or when silk is being dyed that readily chafes. They are particularly useful in stripping and redyeing silk hosiery. Three to five per cent of a protective colloid, with five per cent of a high grade sulfonated oil, or of the lubricating type sulfonated fatty alcohol, should be used in both the stripping and dye bath.

They are also applicable to wool. It is a known fact that weak alkalis at high temperatures remove sulfur from wool, render the woolen fiber brittle and lusterless, turn it yellow and decrease its strength. The use of these agents prevents the action or greatly minimizes it.

In conclusion, I should like to remind the dyer and finisher that correct machine loads for scouring, dyeing, and finishing operations are a very important factor in obtaining high grade uniform results with all textile agents. If the machinery is overloaded the liquor does not circulate properly. If the fabric is packed too tight, complete penetration is impossible. In other words, no matter what or how much penetrant, leveling or protective agent is used, high grade uniform results are impossible.

Calcium Carbonate*

R. E. ROSE**

CALCIUM carbonate has played a principal role in the evolution of the earth's crust, of living things and of civilization.

Probably all the calcium carbonate of the earth was originally silicate, this was attacked by water containing carbon dioxide and converted into lime. At present, and for many thousands of years, the equilibrium alters very slowly, the atmosphere contains some 2,200,000,000,000 tons of CO_2 and in the earth's crust there are roughly 66,000,000,000,000 tons of calcium carbonate; all of which is sedimentary. Limestone is dissolved and carried down to the sea, there it is used by small marine animals and plants such as foraminiferae, corals and algae. The lime is precipitated in the amorphous form but is rendered crystalline by the animal—this is of great importance because the ocean is not saturated with lime and the crystalline modification of the compound is much less soluble than the amorphous. The peculiar weathering of limestone areas, by solution and not by attrition, gives rise to underground hollows, forming beautiful caves sometimes decorated with stalactites and stalagmites. These caves were the first "homes" of our remote ancestors and their history is legible in the deposits left in the caves by them.

The first great architectural endeavors of mankind were made using limestone, the pyramids of the Nile Valley were of marble or at least marble faced.

The consummate art of the Greeks rests on the characteristics of marble, a uniform micro crystalline mass, that can be worked with ease but is not soft enough to be fragile. The Greeks used this same material in their statuary which, starting with impassive Gods, ended with exquisite idealizations of all the beauties of human form and dress—all in a short hundred years. Almost the same course was followed by the artists in stone of the medieval period who started with limestone figures, rigidly constrained by architectural members and finally made lifelike figures stepping out of their stone matrices.

By reversing the natural process and making calcium carbonate into the silicate, i.e., mortar, the Romans added to the stability of their work in brick, tile and stone. We now use this material in a much finer form and containing aluminum silicate as a binder for sand and gravel in con-

*Abstract of an address delivered before the Rhode Island Sections of the American Chemical Society and the A.A.T.C.C. on February 10, 1938. Reprinted from "The Nucleus."

**E. I. Du Pont de Nemours & Co.

crete, a material that has transformed our architectural surroundings, our highways and bridges.

Limestone gave man one of his first controlled chemical reactions, $CaCO_3 \rightarrow CaO + CO_2$, and this eventually grew to be the beginning of the caustic alkali industry. From it came "bleaching powder," the basis for the great cotton industry.

Lime is the natural "neutral" alkali, everywhere in nature it tends to fix the acids of life processes and liberate other essential elements such as potassium for plant growth. The calcium-phospate balance in the animal body is fundamental to existence in the vertebrates, and the element calcium is essential to the functioning of all protoplasm.

Calcium carbonate has its disadvantages, it gives rise to the temporary hardness of water which wastes soap and produces as it does so, clots that are very hard to remove, particularly from textile fibers.

This disadvantage is being overcome by using new detergents that do not form a curd. Even if the lime present is enough to cause a precipitate, this is very light and fluffy and rinses off easily.

The history of mankind and of the world before man is written in the record left by the association of calcium carbonate and life. In the Grand Canyon of the Colorado is to be read the history of a thousand million years and yet the last page brings life only to the age of the very primitive amphibians when the dinosaurs were still 300 million years unborn. The great pages of that history are in schist, shale, sandstone and limestone, but the imprint is in calcium carbonate, in the skeletons of living things.

Whatever our future may be it is certain that we are writing our imperishable history with limestone now more than ever in the past.

ONE HUNDRED AND TWELFTH MEETING OF THE RESEARCH COMMITTEE

THE 112th meeting of the Research Committee was held at the Engineers' Club in Boston, on Friday afternoon, October 21, following the Council meeting. Present were Chairman Louis A. Olney presiding, W. D. Appel, J. R. Bonnar, K. H. Barnard, W. H. Cady, Hugh Christison, C. Z. Draves, W. C. Durfee, Alban Eavenson, H. F. Herrmann, D. R. Kneeland, W. R. Moorhouse, G. A. Moran, E. R. Schwarz, W. M. Scott, H. M. Stiegler, W. S. Williams, and H. C. Chapin.

The general research and year book program was discussed by the Chairman. Mr. Herrmann suggested that fastness to bleaching tests be extended to cover fastness of dyed materials submitted to hydrogen peroxide bleaching. J. R. Bonnar was appointed Chairman of the Committee on Wet Transfer of Color, replacing Ephraim Freedman, resigned but remaining a committee member. C. L. Nutting was appointed to serve with W. M. Scott as a representative of the Association on the A.S.T.M. Committee on Soaps and Detergents. The resignation of H. A. Neville from the Research Committee was accepted with regret.

There was discussion as to how far the committee should go toward establishing shrinkage tests for wool, silk and rayon, or toward indorsing tests established by others. G. A. Slowinske was appointed a member of Professor Schwarz' Committee on Waterproofness of Fabrics. Mr. Moran, Chairman of the Committee on Wash Fastness for Cotton, discussed recent criticisms of these tests from E. M. Edgerton and C. W. Kuhl. Mr. Appel stated that the British and German Associations had agreed on light fastness standards, to be prepared at one source in Germany. Approval of the same standards having been voted by the committee, it was further voted that such standards be prepared in this country. Markings for light fastness standards already prepared under supervision of Mr. Christison were approved, in order that these standards might be released at once. Mr. Barnard reported for his Committee on Crease Resistance.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary.*

MEMBERSHIP APPLICATIONS

Active

George H. Coates—Supt. of Bleaching and Finishing, Fulton Bag & Cotton Mills, Atlanta, Ga. Sponsors: E. M. G. Schroder, C. A. Jones.

John E. Cole—Research Chemist, Jackson Laboratory, du Pont Co., Wilmington, Del. Sponsors: C. A. Seibert, P. L. Speakman.

Charles E. Doughtie—Supt. Yarn and Hosiery Mill, Georgia Mfg. Co., Columbus, Ga. Sponsors: A. Jones, R. W. Philip.

William E. Kemmerich—Development, Research and Dye Mfg., Zinsser & Co., Hastings-on-Hudson, N. Y. Sponsors: R. M. Ritter, H. W. Dingee.

J. Bryn Lewis—Chemist, Hachik Bleach Co., Philadelphia, Pa. Sponsors: C. Hachikian, A. W. Etchells.

Robert T. Lindsey—Supt. Package and Raw Stock Dyeing, Russell Mfg. Co., Alexander City, Ala. Sponsors: W. F. Crayton, M. L. Kirby.

Sumner E. Shepard—Second Hand, Dye House, Arlington Mills, Lawrence, Mass. Sponsors: C. L. Nutting, H. Christison.

Frederick Spencer—Overseer of Dyeing, Arlington Mills, Lawrence, Mass. Sponsors: C. L. Nutting, H. Christison.

Harold Taylor—Second Dyer, Continental Mills, Inc., Philadelphia, Pa. Sponsors: E. C. Bertolet, J. E. Goodavage.

Associate

Earle M. DeNoon—Owner, South Florida Test Service, Miami, Fla.

Roy T. Fagan—Salesman, E. J. Feeley & Co., Columbus, Ga. Sponsors: A. Jones, R. W. Philip.

Student

Harry M. Fry—Philadelphia Textile School. Sponsor: E. C. Bertolet.

Ralph J. Hoey—Philadelphia Textile School. Sponsor: E. C. Bertolet.

Samuel J. Rexon—Philadelphia Textile School. Sponsor: E. C. Bertolet.

Walker L. Schleyer—Philadelphia Textile School. Sponsor: E. C. Bertolet.

Nathan H. Goldberg—North Carolina State College. Sponsor: A. H. Grimshaw.

MEETING, NORTHERN NEW ENGLAND SECTION

A MEETING of the Northern New England Section was held at the Andover Country Club, Andover, Mass., on Friday, November 4, 1938, with about eighty members present. The following program was presented and was thoroughly enjoyed by those present:

"Protection of the Wool Fiber During Scouring and Dyeing." R. A. Lindenmaier, Sandoz Chemical Works, Inc.

"The Writing Ink Industry." C. H. Schmitt, Carter Ink Company.

Respectfully submitted,

JOHN N. DALTON, *Secretary.*

MEETING, RHODE ISLAND SECTION

THE October meeting of the Rhode Island Section was held in the Providence Engineering Society Rooms at 195 Angell Street, Providence, R. I., on Friday, October 28th, 1938.

The meeting was called to order at 8:00 P. M. by Chairman R. Haworth, and the members stood in silence for one minute in memory of John Masson, a fellow member.

Through the courtesy of the du Pont Company, a sound movie was presented including some of the last World Series highlights and a film entitled "Everybody Ski," depicting sportswear made of spun rayon and featuring the famous ski instructor, Hans Schneider.

The first speaker of the evening was Mr. Reynolds of the Providence-Cranston Community Fund, who made an urgent appeal for donations for the 35,000 members of "Needville." Mr. Reynolds stressed the fact that more than the usual amount is needed from each giver this year because of the recent disaster.

Mr. Frederick Prisley, chemist of the Wanskuck Company, gave an instructive talk on "Some Modern Methods of Grading Worsted Tops."

Mr. Prisley pointed out that previous to 1926 top standards were made in England by top manufacturers in Bradford to specifications agreeable to U. S. merchants. The chief characteristics of a top are fineness, spinning quality, color, and fiber strength, and in this country these had been judged by visual methods only. Economic conditions made it increasingly important that more accurate methods be used, and in this country there is now a table of standards, based on the microscopic method of grading tops.

Mr. Prisley then demonstrated his apparatus for grading wool tops, the results of which are very accurate and expressed arithmetically, making them of more value to the spinner than paper charts.

Mr. Ben Verity of the Carbic Color & Chemical Company presented a very interesting, as well as instructive, paper entitled, "Leaves from a Dyer's Notebook."

The following announcements were made:—

The National Convention of the Association will be held on December 2nd and 3rd at Atlanta, Georgia, and it is urged that as many as possible attend.

The November meeting of the Rhode Island Section will be held on Monday evening, the 21st.

The meeting adjourned at 10:00 P. M.

Respectfully submitted,

LOUIS D. FLEMING, *Secretary.*

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the secretary or the American Dyestuff Reporter any vacancies which may occur in their businesses.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE. Prospective employers may file vacancies either with the secretary or the American Dyestuff Reporter.

A-4

Education—University of South Carolina, New York University, Philadelphia Textile School.

Experience—Chemist for 3 years with dyestuff company; 1 year as chemist in dyeing plant on pure and tin weighted silks and rayon; 3 years plant chemist for cotton dyeing, printing and bleaching plant. Can install Rapidogen system, including construction of necessary equipment.

Married; age 31; references. Will go anywhere.

A-5

Education—Graduate of New Bedford Textile School, three-year chemistry, dyeing and finishing course.

Experience—Tested dyestuffs for all properties; done color matching; analytical laboratory work; made up lacquers and varnishes. Excellent references; will go anywhere; age, 23; single.

A-B-1

Education—Graduate chemist and colorist from a leading textile institute. Speaks French fluently. High standing at school. Awarded 1st prize in chemistry. Member of honor society.

Experience—Knowledge of most processes of textile manufacturing and some experience in woolen and worsted piece and stock dyeing and color matching. Knowledge of finishing. Wishes to get into laboratory or dyehouse.

A-B-7

Education—Evening school in textile dyeing and chemistry.

Experience—Dyehouse laboratory for 2 years. Foreman dyer

and finisher on hosiery for 9 years. Experience on ribbons also vat dyes on rayon and silk skeins. 2 years assistant to superintendent. Desires position either in demonstrating and sales or dyer. Age 31; married.

A-B-8

Education—Graduate Chemist.

Experience—Print superintendent, colorist; eleven years' experience in all types of fabrics, specializing on rayon; 8 years' dyestuff laboratory and demonstrating. Excellent references; age 36; married.

A-B-9

Education—Marquette University; major—chemistry; minor—business.

Experience—8 years' experience in color application in dye test laboratory; practical knowledge of acid, basic, chrome, direct, developed, naphthol, sulfur and vat dyes; good working knowledge of vat and soluble color printing. Desires position that will lead to demonstrator opening. Excellent references; age, 30; married.

A-B-C-4

Education—Educated abroad.

Experience—Twenty years experience in the textile field as bleacher, dyer, finisher and chemist. 16 years in charge of dyestuff laboratory of large dyeing plant, 4 years as chief chemist with large bleachery. Has tested dyestuffs, and chemicals used in the textile field and has manufactured soaps and textile specialties. Has handled all textile fibers; bleaching, printing, dyeing and finishing same. Has done pigment and lacquer printing, waterproofing and fireproofing. Reason for leaving last position was due to business conditions.

Age 41; married.

A-B-C-5

Education—High school textile school graduate (textile school of Barman, Germany).

Experience—8 years skein and ribbon dyer; 2 years chemist-colorist laboratory work in Germany. 10 years boss dyer and superintendent for finishing in leading ribbon mill. German; American citizen; married; 40 years of age and willing to go anywhere.

A-B-C-6

Education—English Municipal School of Technology; Board of Education, So. Kensington Chemistry Certificates; City & Guilds of London Institute in Bleaching and Dyeing.

Experience—In U. S. A. 22 years as chemist and chief chemist with one of the largest textile plants in the country; expert colorist; long experience with permanent and semi-permanent finishes. Specialist on vats, naphthols and indigosols. Age 49; married.

A-B-C-7

Education—B.T.C., Lowell Textile Institute, member of honor society; speaks French fluently.

Experience—3 years as textile research chemist in charge of dye house and advisory to purchasing for large Canadian plant. Experienced in woolen and worsted yarn dyeing, for weaving and knitting; raw stock, top dyeing, piece goods dyeing and finishing. Laboratory practice in planning and checking methods and processes, costing and purchasing. 1 year experience as assistant dyer in top dyeing and print works. 1 year as chief chemist in cotton mill in charge of laboratory and control work of vatcolors, naphthols, sulfur and developed colors.

Married; age 28; references; American citizen; will go anywhere; desires opportunity to prove capacity.

A-B-C-F-1

Education—Textile institute course; extension work at Brown; executive training with Alexander Hamilton Institute; knowledge of German.

Experience—Dyeing executive in all types of textiles, including stock, yarns, and piece-goods. Thorough knowledge of all classes of dyes and dyestuffs, and their successful practical application in the plant. Wide experience in all types and makes of equipment used in dyeing, bleaching, mercerizing and finishing. Laboratory practice in planning and checking methods and processes, costing and purchasing. Good manager personnel for efficiency and satisfactory results economically obtained. Cotton, rayon and silk, some acetate rayon, and mixed fabrics. Age 46; excellent references; in excellent health.

A-B-C-F-2

Education—Lowell Textile Institute, 1911.

Experience—26 years in cotton yarn and piece goods finishing plants; expert on naphthols, vats and other cotton and rayon dyeing; all types of control work and testing; analytical processes; purchasing of dyes and chemicals. Age 46; excellent references; in perfect health; will go anywhere; married.

A-B-D-1

Education—Randolph Macon College; Facett (Art major, design and chemistry).

Experience—2 years in dry color house as colorist, control and technical sales; 2 years with paint manufacturing laboratory control and plant work; 2½ years with dyestuff manufacturer on technical sales, research on organic pigments, paper dyeing and textile colorist on directs, acids, and printing. Interested in position as technician and sales with color laboratory.

A-B-F-1

Education—Technical School. Dyeing and Chemistry.

Experience—Mill chemist. Dyer: yarns, tops and rawstock; wool, cotton and rayon. Vigoreaux printing. Bleaching. Would like position as dyer, chemist or demonstrator. Business conditions reason for leaving last position. Excellent references. Age 45.

B-3

Experience—Foreman piece dyer for the past 21 years. Can dye the following: rayon, cotton backs, wool, silk and mixed fabrics. Has knowledge of finishing and laboratory work.

B-4

Experience—Foreman dyer in charge of ribbon dyeing for 20 years. Experienced on silk, cotton, rayon, acetate yarn. Age 41; will go anywhere.

B-5

Education—High School and Textile School Graduate.

Experience—Twelve years overseer of dyeing on directs, vats, naphthols, sulfur, basic and developed colors. Also experienced bleacher. Age 40; married; references.

B-6

Education—Textile School Graduate.

Experience—Former instructor in chemistry and dyeing. Twelve years' experience as overseer of dyeing of vats, naphthols, developed, indigosols, sulfur and direct colors on piece goods. Age 35; excellent references.

B-C-1

Experience—20 years experience in dyeing and finishing departments; 15 months as general superintendent of well known woolen mill. Capable of handling dyeing alone or in combination as superintendent of dyeing and finishing.

Age 40; references.

B-C-2

Experience—12 years foreman piece dyer on vats (pigment), naphthols, soluble vats, sulfurs, developed, basics and directs. Pads, jigs, boxes and continuous machines. All constructions of cottons and rayons. Full practical knowledge of bleaching, mercerizing, and working knowledge of most finishes and finishing machinery. Could take charge of entire wet processing.

Age 38; married; references.

B-C-3

Education—Graduate, Philadelphia Textile School; speaks German fluently.

Experience—Employed at velvet company for 7½ years. Past 2 years working in finishing department on regular, waterproof and crush-resistant finishes (resin finishes). Can take charge of finishing of velvets. Have some piece dyeing experience.

29 years of age; married; will go anywhere.

B-D-1

Education—Received early training in England and attended technical college there.

Experience—Dyeing executive; all types of ladies and men's hosiery and all types of textiles including stock, yarns, piece goods and government uniforms; woolen and worsted suitings; cotton, silk and rayon on yarns, piece goods and mixed fabrics; thorough knowledge of all types of dyes, successful application of same and laboratory work. Fourteen years with one employer; business conditions reason for unemployment.

Age 52; married; English American; sober and reliable. Desires position as dyer or demonstrator and service man for dye company.

F-1

Education—Two years high school; 6 years evening engineering school; 1 year evening textile school; 1 year industrial management; course in accounting.

Experience—Ten years in an executive capacity in full fashioned hosiery manufacturing business. Familiar with entire manufacturing procedure, finishing dept., dyehouse and office. Specialized in finishing dept. and has good eye for color, finish and quality. Had responsibility of all orders going through mill, stock, grey goods and traffic. Five months in New York sales office. Gets along well with people and contact with employees and customers has always been satisfactory. Previous to hosiery experience was in a mechanical business for 17 years.

43 years of age; single, in good health; will go anywhere.

The Processing of Acetate and Viscose Rayon Fabrics

(Continued from page 732)

5. The dispersing agents if they are retained on the dyed fabric must be free from causing trouble in the dyeing and finishing.

Acetate dyes and their dyeing characteristics are distinctly different from the older accepted conception of dyeing processes for silk and wool and the other vegetable fibers such as cotton and the regenerated rayons (viscose, cuprammonium and nitro).

There have been many theories advanced for these dyeing properties of acetate dyes on the acetate fiber, but the two that are recognized as offering the best answers at present are:

1. The chemical combination between acetate dyestuff and acetate fiber with the final shade resulting from the reaction that has taken place in the dyeing operation.

2. The solid solution theory bases the dyeing operation on the theory that acetate dyestuffs are dissolved or absorbed by the acetate fiber from the highly dispersed state of the dyestuff in the dyebath.

Another characteristic of the acetate dyes is that a majority of them are organic compounds that possess lower melting points than some other types of aniline dyestuffs. This property shows the necessity of preparing acetate dyes with suitable dispersing agents, adding hot water with stirring, or only at a light boil-up of not more than 2 or 3 minutes. Never give a hard "boiling-up" of 10 minutes as some of the less soluble directs and natural silk colors are sometimes dissolved.

The operation of dye baths containing acetate colors at a boil is not recommended and if continued over a long period may result in the partial precipitation of the dye bath and the tarry precipated particles clinging to the fabric or falling to the bottom of the dye bath.

The acetate fibers are very slow to wet out thoroughly so it is considered best to either give a short pre-scour preliminary to starting up of the dye bath or to heating up dye bath and run the goods in this bath the necessary times for thorough wetting out before the prepared acetate dyes are entered.

These wet out acetate fibers are quite plastic in the hot dye bath and it is always advisable to gradually cool the goods whether it be the completion of a dyeing or scouring operation. Careful adherence to this recommendation will help to free the dyed goods of cracks or break marks and creases.

One of the questions that confront the textile chemist and dyer of acetate and viscose rayon crepes is the selection of the most suitable standard dyeing procedures. These procedures must be easy for the operatives to follow and so arranged that the introduction of chemicals, dyestuffs, and dyeing temperature changes can be all carried out without too many complex situations occurring during the dyeing operation.

Roughly, the standard dyeing procedure may be worked out for the crepes using the higher dyeing temperatures and those using the lower temperatures. The writer is giving the following classification for each.

High Dyeing Temperatures

Gamsas

2 x 2 in 150—100 denier construction

4 x 4, etc.

Crepons, Krinkle Krepes, etc.

Thick and thins or slubs

Low Dyeing Temperatures

Alpacas (staple or novelty qualities)

Romaine (staple or novelty qualities)

Practically all of the different qualities of fabrics using higher dyeing temperatures can be boiled-off on the continuous boil-off and scouring method as described under the heading, "The Continuous Boil-Off and Scouring Method Used," Part I of this article. Some of these goods can be run at higher creping speeds than other qualities. The 2 x 2s and gamsas can be run off at higher speeds than novelty qualities such as the "slubs" or "thick and thins" which must be run very slow so as to give it more creping and scouring action for the best results to be obtained on the finished fabric.

Gamsas and 2 x 2 qualities are easier of penetration and require less scouring action than is necessary for other qualities.

On the other qualities, there are different variations for production speeds and this must be observed more by commission dyeing plants than dyehouses operating on goods woven in their own manufacturing department.

The low dyeing temperature goods such as staple and sheer qualities of Alpacas and Romaines are boiled-off on the "book" or folded form using bent sticks to work the goods in the boil-off bath. This boil-off method is outlined in Part I under the heading of "Boil-Off and Scouring Processing Formulas, etc." There is a trend toward the use of the continuous boil-off and scouring method for some qualities of Romaines such as the ribbed fabric through the use of conveyor nets and by wrapping the initial wetting-out cylinder as the greige goods enter the boil-off. The production speed is very slow for satisfactory creping of these heavier qualities of crepe fabrics.

The newer ideas now being worked out are to eliminate the expensive handling by hand of alpacas and romaines in the book and folded form. This will be discussed in detail under a subsequent part of this article.

PRESCOURING BEFORE DYEING OPERATION

For creped goods requiring the higher dyeing temperatures, the prescouring is optional with most dyers except on 4 x 4 and Krinkle Krepe qualities and goods that are sized with partially insoluble types of warp sizing that

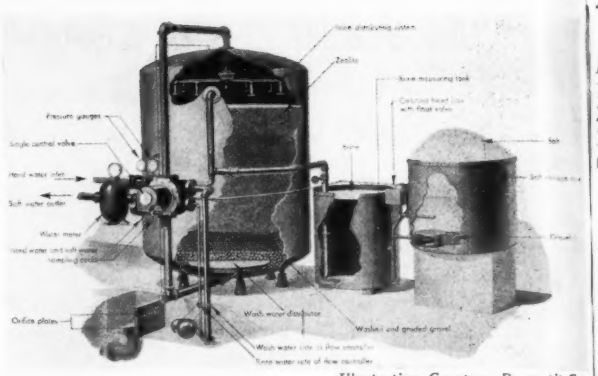
have not been completely removed during the regular boiling-off and scouring bath, to secure satisfactory penetration on the acetate and viscose rayon fibers. The heavier crepe fabrics requiring the low dyeing temperatures are usually given a prescour as it is valuable for scouring and chiefly aids in wetting-out goods preparatory to dyeing.

TYPICAL PRESCOUR FORMULAS

(Suitable for all qualities of creped fabrics)

(All formulas based on a 12 foot box, approximate capacity of

1300—1450 Gallons
5400—6000 Liters
450— 650 pounds (25 to 40 pieces of crepe is the amount of goods that can be processed in this capacity box or dye-beck.)



Illustration, Courtesy, Permutit Co.

Fig. 12—Typical Zeolite Down-Flow Single Valve Water Softener with Sections Cut Away to Show Details of Construction.

Prescour Formula No. 1

(For use under "hard" water of 20-50 P.P.M.)

English Measure	*Metric Measure*
1.0 to 3.0 lbs. Soda Ash or Tri Sodium Phosphate	0.07 to 0.20 grams/liter
1.0 to 3.0 lbs. Sulfonated fatty alcoholate paste	0.07 to 0.20 grams/liter
5 to 10. pints—30% Hexa-meta-phosphate solution	0.4 to 0.80 cc/liter

On Zeolite softened water of "zero" hardness the water conditioning agent (hexa-meta-phosphate) may be omitted. (See Figure 12—Zeolite Water Softener.)

Prescour Formula No. 2

(For use under "hard" water conditions of 20-50 P.P.M.)

English Measure	*Metric Measure*
1.0 to 3.0 lbs. Soda Ash or Tri Sodium Phosphate	0.07 to 0.20 grams/liter
1.5 to 4.5 lbs. Low titer soap	0.10 to 0.30 grams/liter
6.0 to 12.0 pints—30% hexa-meta-phosphate solution	0.5 to 1.00 cc/liter

On "zero" hardness water the hexa-meta-phosphate may be reduced 80 per cent or omitted entirely.

Prescour Formula No. 3

(For use under "hard" water conditions of 20-50 P.P.M.)

English Measure	*Metric Measure*
1.5 to 3.0 lbs. Tetra Sodium Pyro Phosphate	0.10 to 0.30 grams/liter
0.5 to 1.5 lbs. Sulfonated fatty alcoholate paste	0.035 to 0.15 grams/liter
2.0 to 6.0 pints—30% meta-hexa-phosphate solution	.015 to 0.50 cc/liter

On zero hardness water the hexa-meta-phosphate solution may be omitted.

Prescour Formula No. 4

(For use under "hard" water conditions of 20-50 P.P.M.)

English Measure	*Metric Measure*
1.5 to 3.0 lbs. Tetra Sodium Pyro Phosphate	0.10 to 0.20 grams/liter
0.75 to 2.25 lbs. Low titer soap	0.05 to 0.15 grams/liter
2 to 6 pints 30 per cent hexa-meta-phosphate solution	0.15 to 0.50 cc/liter

On zero hardness softened water the hexa-meta-phosphate solution may be omitted.

Whenever the goods become too full of air or very buoyant in the bath, they will float and pile up on the back board. It is then necessary to add a suitable agent that possesses wetting-out and defoaming properties to the bath so that the goods will sink properly and carry through the bath without excessive tension being exerted by the reel in pulling the goods. If any particular quality of crepe shows this tendency to become excessively buoyant in bath, it is then best to reduce the amount of soap or fatty alcoholate and replace this portion with a satisfactory penetrant or wetting-out agent.

Formulas No. 1 and No. 2 will give good results on lighter weight crepes while Formulas Nos. 3 and 4 will give satisfactory results on the heavier weight crepes. A prescouring temperature of 180-200° F. will give good results on the lighter weight crepes with any of the prescour formulas, but it is advisable to prescour at 150-170° F. on the heavier weight crepes. The time necessary for satisfactory results varies from 30 to 90 minutes dependent upon quality of crepes being processed, dye-boxes used, and local steam supply.

Dyebath Formula No. 1

English Measure	*Metric Measure*
1.0 to 2.00 lbs. Soda Ash or Tri Sodium Phosphate	0.7 to 0.15 grams/liter
2.0 to 6.00 lbs. Olive Oil Soap	0.15 to 0.45 grams/liter
1.0 to 2.0 lbs. Wetting-out Agent	0.07 to 0.15 grams/liter
6 to 15 pints 30% Hexa-Meta-Phosphate	0.5 to 1.25 cc/liter

Dyebath Formula No. 2

English Measure	*Metric Measure*
2.0 to 4.0 lbs. Soda Ash or Tri Sodium Phosphate	0.15 to 0.30 grams/liter
1.0 to 2.0 lbs. Sulfonated Fatty Alcoholate paste	.07 to 0.15 grams/liter
2.0 to 4.0 lbs. Wetting-out Agent	.15 to .30 grams/liter
5 to 12 pints 30% Hexa-Meta-Phosphate	.40 to 1.25 cc/liter

Dyebath Formula No. 3

English Measure	*Metric Measure*
0.75 to 1.50 lbs. Tetra Sodium Pyro Phosphate	0.05 to 0.10 grams/liter
0.75 to 1.50 lbs. Sulfonated Fatty Alcoholate Paste	0.05 to 0.10 grams/liter
1.0 to 3.0 lbs. Wetting-out Agent	0.07 to 0.20 grams/liter
2 to 6 pints 30% Hexa-Meta-Phosphate	0.15 to 0.5 cc/liter

DYE BATH PREPARATION

All dyeing formulas (see tables above) are arranged for "hard" water conditions of 20-50 PPM and if zeolite softened water of zero hardness is available then the hexa-meta-phosphate may be reduced 80 per cent or omitted entirely.

The dyebaths under "hard" water conditions are best prepared by entering 2/3rds of the hexa-meta-phosphate solution to the cold bath, then adding ½ of required amount of alkalies, soap or fatty alcohols, and wetting-out agent in the order named. After the bath has been prepared, the goods, which are already entered on box and ready for dyeing, are then given five minutes running in the bath as it is raised to 110-120° F. which is the usual entering temperature for the prepared acetate and substantive rayon dyestuffs.

The remaining portion of the soap or sulfonated fatty alcoholates is usually used in pasting up and preparing the dyestuffs, while any unused portion will be required in subsequent preparation of dyestuff addition to obtain the necessary shade.

By entering only 50 to 75 per cent of the chemicals in the dye bath at the start of dyeing operations, the dyer reduces the tendency of the bath to foam excessively which will cause the goods to float and tangle during the period that the dye baths temperature is being raised to the required dyeing temperature. This addition of steam plus the agitation causes the bath to foam rather heavily and as soon as the dyeing temperature has been reached and the salt addition is made, then this foamy condition is greatly reduced. So by holding out a given portion of the dye-bath ingredients and adding these after the first or second dyestuff "shading" additions are made, then the dyebath is given a more stable character. Dyeing results can be duplicated much easier by this "split bath" method than by haphazard addition of soaps, alkalies, etc. during the dyeing operation whenever the operative thinks the dyebath appears too flat or there are no suds on surface. Whenever dye baths appear "flat" continually, then the dyer must investigate and correct the condition with necessary increased amounts of required materials otherwise the acetate dyes will tend to precipitate out of the dispersed state and the final shade will finish up dull and flat, with lower color value obtained from the dye bath.

LOADING OF CREPE PIECES INTO DYE BOX

Fill up dye box ¾ full of cold water and enter hexa-meta-phosphate solution if water is hard, otherwise omit hexa-meta-phosphate.

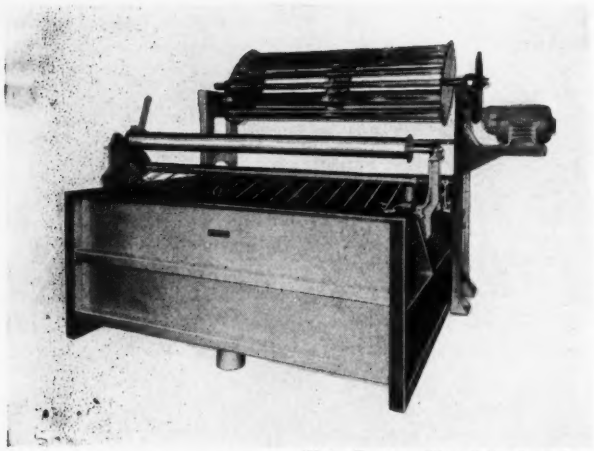
Methods Used on 2 x 2, 4 x 4, Gamsas, etc.

There are several methods of loading on light weight crepe. The two methods that are the quickest and most free from tangled goods during the dyeing require two operatives and are the most economical as to time and results obtained: (Variations of these methods can be used according to the type of dye-boxes used whether enclosed or open type.)

See Figures 13 and 14—dye-boxes—of these two types.

Method No. 1

Trucks are placed with creped pieces at front end of open type of dye-box, the operatives open pieces usually four at a time into box, pull the set of ends out and throw over the large reel on back which is revolved and this pulls goods over into back of box. The ends coming over the reel are laid over the back of box in consecutive order. Pieces are numbered and the revolving reel pulls the pieces on through water and folds them in back part of box. As the other end of each piece comes over the reel, it is then pulled under the back board and front roll and wrapped around a finger that supports the pieces. These ends are placed in exact consecutive numerical order on front as on back of boxes so as to prevent the mixing of the ends of the different pieces together.



Photo, Courtesy, Riggs & Lombard, Inc.

Fig. 13—Open Type Dye Box

This operation is repeated until all pieces in the particular dye lot are entered, then the ends are unwrapped and a sufficient amount of the goods is pulled through the water so that each end can be thrown over reel and matched with its correct number on back. These two ends are then looped together ready for final checking of list of pieces from dye lot ticket before they are sewed together.

The sewing, on this method of loading, can be carried on by using a medium sized bagging needle with a soft cord of sufficient tensile strength but not so hard a twist that it will cut the crepe fabric and pull out.

Fig. 15—Electrically Driven Chain Stitch Machine.

Illustrations, Figs. 15, 16 and 17, Courtesy, Singer Manufacturing Co.

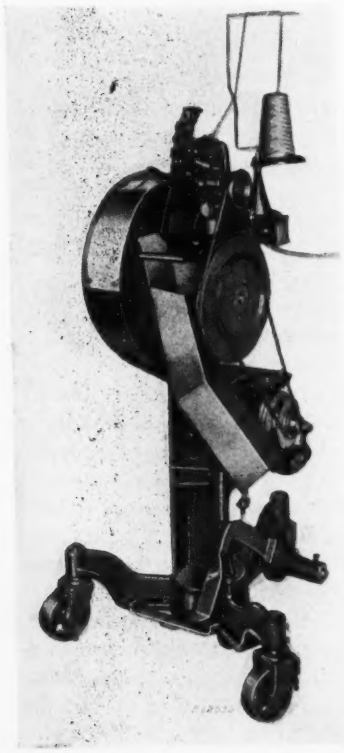


Fig. 16—Single Thread Overedge Seam Produced by Machine Shown in Fig. 15.

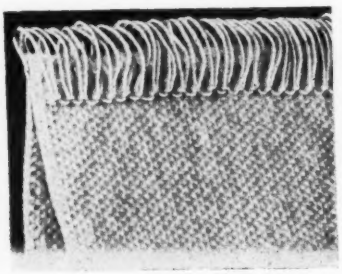
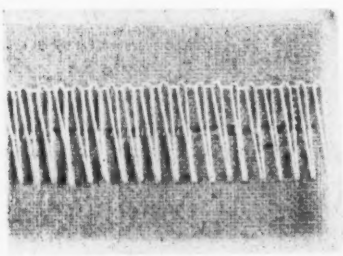
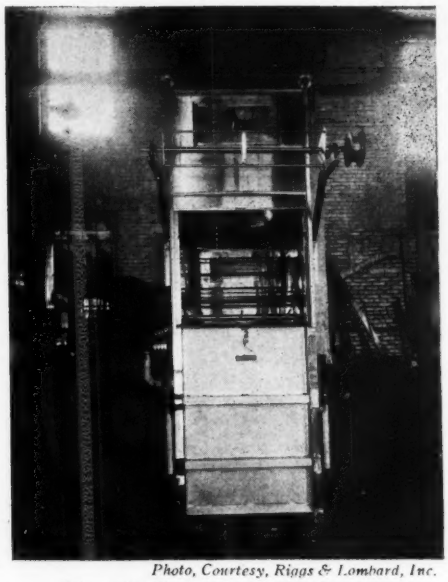


Fig. 17—Seam Shown in Fig. 16 Abutted on Removal from Machine.





Photo, Courtesy, Riggs & Lombard, Inc.

Fig. 14—Enclosed Type Dye Box

The operatives sew from opposite ends of box and must loop and tie each sewn end securely to prevent them coming loose and tangling the pieces during the dyeing operation.

A preferred method of sewing is the use of an electrically driven chain stitch machine. This machine gives an open or full-width sewed end on each piece of crepe. The full-width sewing helps to prevent the uneven dyeing on the sewed ends which is so prevalent on pieces sewed by hand using a bagging needle. Threads used on chain stitch machine are cut or tied together to prevent raveling of the sewed ends during the dyeing process.

Fig. 18—Saturated Brine Making Unit (Plant Installation)

Photo, Courtesy, International Salt Corp.

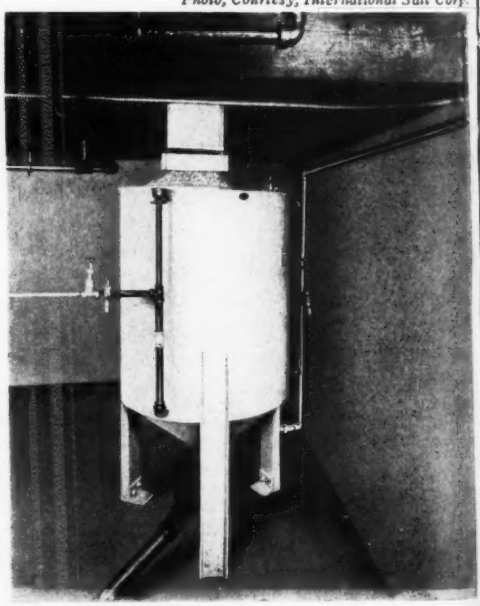


Figure 15 shows a photograph of electrically driven chain stitch machine.

Figures 16 and 17 show the over-edged seams produced on this type of machine.

Method No. 2

Trucks with goods are placed in front of machines and operatives work from each side. Each operative opens up a piece on his respective side of box, holding one end and threading under front roll and through opening, then pulling it over to his side of box. The other end, which is laid over back board to keep it in place, is now threaded under and over large reel at back and the two ends pulled together and sewed by hand using a bagging needle threaded with soft cord as previously described. The sewn ends are securely looped and tied in order to prevent raveling and tangling of ends during dyeing.

This method of loading from the sides can be worked satisfactorily with a sewing machine by allowing one operative to operate the machine while the other loads on.

The loading-on operative must throw the front end over large reel so that the sewing machine operatives can carry out the sewing at the back of box since there is rarely enough space for machines sewing by the side of a box.

This method of loading-on is rapid and accurate when operatives are properly trained and are used only for loading pieces on boxes when this operation is required in the dyehouse.

Method Used on Alpacas, Romaines, and Heavier Crepes

The loading on of the heavier crepes is usually carried out in the open width by the removal of the fingers or pegs from the front roll of box. The loading on method is similar to Method No. 1 described for lighter weight crepes. It is necessary that the heavier crepes be opened full width and entered without any folds or twists throughout the entire piece before the ends are sewed together. This is necessary to prevent break marks or cracks that would occur in dyeing if the goods were entered similarly from bundles as the lighter crepes usually are.

The strongest type of sewing thread must be used on these heavier goods, and it is sometimes advisable to sew the ends twice to prevent raveling and tangling in the dye bath.

STANDARD DYEING PROCEDURES FOR CREPES AT HIGH DYEING TEMPERATURES

1. Direct dyeing acetate and substantive rayon colors.

a. Load on, check piece numbers, sew and prescour.
b. Prepare dyebath cold, run goods 5 minutes.
c. Raise to 120° F. Shut off steam, add acetate first, rayon colors second.
d. Raise to 180° F. Run 15 minutes, shut off steam, add ½ brine or salt.
e. Raise to 200° F. Run 15 minutes, shut off steam, add ½ brine or salt.
f. Run at 200° F. 30 minutes. Sample for shade.
g. If shade not okeyed by dyer, make color addition, shut off steam, strain in prepared color, run 30 minutes.
h. Sample. If okeyd by dyer, wash over till cool.
i. Drop and wash till clear. Test for crocking.
j. Finish No. 1—Add brine or salt to final rinse and bundle from bath.

Finish No. 2—See dyer for finish. Add to final rinse, run at 100° F. 10 minutes, bundle from bath.

Suggestions for Instructing Operatives to Carry Out These Procedures

1. Be certain that the pieces are running evenly and free from tangles before dyestuff is added.

2. If bath is too foamy and goods tend to float, see dyer before dyestuff is added. The bath should have a defoaming agent added or drop part of bath, fill up with water, then add dyestuff.

3. The best system is to have a regular man to prepare dyestuff for machine operatives and bring this color to the dye box. This keeps the operative by the dye box at all times and permits a more carefully operated machine.

4. The dyestuff can be carefully added at machine if straining boxes with cotton cloths are provided operatives; otherwise it is more economical to strain dyestuff in drug room, thus making one man on each shift responsible for this very particular job.

5. It is best to run goods 10-20 minutes at 120-140° F. after colors are entered, then raise temperature to 180° F. This helps disperse the colors uniformly through bath and is preferred to turning on steam rapidly which may cause uneven dyeing of rapid exhausting colors.

6. Common salt in "crystal" form is usually used on the lighter weight crepes. Many plants find it quite economical to use a saturated brine solution prepared from lower grades of salt that could not be added directly into dye bath. Using salt in the brine form aids the dyer to keep the dyed crepes cleaner and brighter.

The factors that produce economies through the use of saturated brine are:

1—The initial cost of the lower grades of salt.
2—A properly engineered system of handling the salt.
3—The reduction in percentage of "actual salt" used through this method in place of the older ones.

(See photograph of brine making unit (plant installation) Figure No. 18).

7. The hot dye bath when a shade is approved should never be dropped and crepes run in cold water. It is necessary to wash over bath till goods are cool to the hand then drop and wash till clear.

8. There are two general methods of finishing. One is to add brine or salt to final rinse water and bundle the goods direct from it. These goods then have the finishing agents applied on the quetsch. Another method is to omit the salt in final rinse and add a finishing agent, run 10 to 20 minutes and then finish the goods without running through the quetsch. This helps to prevent a two-sided or shaded effect that is blamed on the quetsch method of applying the softener or finishing agent to the goods.

2. Developed Acetate and Substractive Rayon Colors. (Navy, black, and wine).

a. Loading and sewing on of pieces.
b. Pre-scour not usually used on developed shades.
c. Preparation of dye bath and starting up of machine.
d. Preparation of dyebath (No. 2 and 3 are preferred for developed colors) and entering of dyestuff strained through jute bagging.
e. Goods run at 120-140° F. for a few minutes, steam turned on and bath raised to 180-190° F. in 30 minutes.
f. Dye-bath runs 45 minutes.
g. Rock salt or brine solution added with steam cut off, then turned on and run 30 minutes at 180-190° F.
h. Dye lot sample is taken, diazotized and developed in laboratory for shade before being washed over.
i. Shade is checked and goods are washed over till cool, then bath is dropped, and goods given 2 to 4 cold and luke warm washes until bath is clear. Drop bath and bring up cold ready for diazotizing operation.

Diazo Bath—Run cold 30 minutes.

(If tap water not over 70-80° F., this will give satisfactory diazotizing).

12 feet box—1300-1450 gallons capacity.
5400-6000 liters capacity.

English Measure	*Metric Measure*
25 lbs. Sodium Nitrite	2 grams/liter
5 gallons Muriatic Acid (Hydrochloric)	3.5 c.c./liter

Enter the dissolved Sodium Nitrite into cold bath, stir thoroughly and disperse through bath by opening steam valve slightly. The Hydrochloric acid properly diluted is added to bath with stirring.

Run for 30 minutes cold, wash over, and drop bath twice, then bring up goods in a fresh cold bath, ready for developing.

Developing Bath—Method No. 1

English Measure		*Metric Measure*
3 to 6 gallons 28% Acetic Acid	2 to 4	cc/liter
6 to 8 lbs. BON (Beta Oxy Napthoic Acid)	0.32 to 0.4	grams/liter
1.5 to 2.0 lbs. Caustic Soda flakes (Use either caustic)	0.08 to 0.10	grams/liter
2.0 to 3.0 lbs. Ammonia (soda or ammonia)	0.10 to 0.15	grams/liter

Preparation of BON—

BON is pasted with cold water, the caustic soda previously dissolved, is added with stirring, and the mix is heated with steam until dissolved. BON is pasted with cold water, the ammonia is added with stirring and then hot water is added until BON is dissolved.

Developing Bath—Method No. 2

English Measure		*Metric Measure*
1.5 to 3 gallons 28% Acetic Acid	1 to 2	cc/liter
6 to 8 lbs. BON (Beta Oxy Napthoic Acid)	0.32 to 0.4	grams/liter
1.0 to 2 lbs. Sulfonated fatty alcoholate Paste	0.07 to 0.15	grams/liter

Preparation of BON—

The BON is pasted with cold water, then a hot solution containing the fatty alcoholate is added with stirring, and extra boiling hot water is added to disperse the BON.

The acetic acid is added and goods run 5 minutes in cold bath before the prepared BON solution is strained into bath through cotton or burlap bagging.

After running 5 minutes in the cold bath, the temperature is gradually raised to 130-140° F. on navy, and 140-160° F. on blacks, where it is run for 45 minutes. The goods are sampled and if shade is satisfactory, the bath is washed over till cool and dropped.

The dyed goods are washed till bath is clear and goods are sampled for crocking. If shade crocks, the goods are washed in luke warm bath until satisfactory.

Goods to have finishing agent added on quetsch are given an acetic acid rinse in final bath and bundled ready for finishing.

Add the finishing agent direct to final rinse and bundle ready for finishing.

Precautions to Observe on Diazotizing and Developing Baths

Diazo Bath

1. Protect the goods from direct or indirect sunlight.
2. Do not permit the operatives to finger or handle goods during this operation unless goods become tangled.
3. Check the bath with potassium iodide paper through diazo bath to see that the bath is active with nitrous gas. If test is negative it is necessary to add sufficient hydrochloric acid and nitrite to freshen bath.
4. Keep a check of pH value of bath at the start, and select a slightly acid value of 2 to 4 pH and maintain that as standard pH value for all diazo baths.

Developing Bath

1. Protect the goods from handling and sunlight until they have been developing at least 30 minutes.
2. Check the acidity of pH value of the bath as it is quite necessary that this value be duplicated from lot to lot if shade is reproduced satisfactorily.
3. Methods 1 and 2 for BON give satisfactory results. The No. 1 is used more and is considered "foolproof" while on the No. 2 method the BON may not always be properly dispersed.

Standard Procedure for Developed and Substantive Rayon Colors

(Condensed for plant use as follows)

a. Load, sew, pre-scour, and prepare dye-bath.

b. Shut off steam, add prepared dyestuff solution at 120° F.
c. Raise to 180° F.—shut off steam—add ½ Brine or Salt.
d. Raise to 190° F.—shut off steam—add ½ Brine or Salt.
e. Run 15 minutes at 190° F.—Sample and develop in laboratory.
Run 30 minutes at 190° F.—See dyer—if lab test is O K—then
f. Wash over till clear—check rinse water with dyer.
g. Give 3 or 4 washes at 90° F., then sample for crocking.

Diazo Bath—Cold

Add dissolved Sodium Nitrite into bath—run 5 minutes—add diluted Hydrochloric Acid—See dyer for tests on bath—Run cold 30 minutes, wash over and drop twice.

Developing Bath—Cold

Add acetic Acid—run 5 minutes.

Add prepared BON—Method No. 1—(Checked by Dyer).

Method No. 2—(Checked by Dyer).

Raise slowly to 130-140° F. for navy and run 45 minutes.

Raise slowly to 140-160° F. for black and run 45 minutes.

Sample shades—If OK wash over till clear—Sample for crocking.

If not satisfactory run 2-4 washes at 90° F.—check for crocking.

Finishing bath with Acetic Acid or Finishing agent—Bundle from bath.

LOW DYEING TEMPERATURES

Direct Dyeing Acetate and Substantive Rayon Colors

a. Load, sew, and pre-scour at 140° F.
b. Prepare dyebath—Use formula No. 3—raise to 130° F.—Run 10 minutes.
c. Shut off steam—Enter strained dyestuff—run 10 minutes.
d. Raises lowly to 160° F.—run 40 minutes.
e. Raise slowly to 170° F.—run 40 minutes.
Add pyro phosphate to bath.
f. Shut off steam—add Glaubers salt or brine—see dyer.
g. Run at 170° F. 30 minutes—Sample—If OK
h. Wash over slowly till cool—drop bath.
i. Wash till clear—check for crocking.
j. Add finish to bath—run at 100° F. for 10 minutes.
k. Take off machine in open width and fold goods length-wise.
l. Load goods ready for vacuum extractor.

Procedure for Developed Acetate and Substantive Rayon Colors

a. Load and sew on goods.
b. Prepare dye bath at 90° F.—Use formula No. 3.
c. Raise bath to 130° F.—Run goods 10 minutes.
d. Add acetate color—Run 10 minutes.
Add substantive color—Run 10 minutes.
e. Raise slowly to 160° F.—Run 45 minutes.
f. Raise to 175° F.—Run 15 minutes.
g. Add pyro phosphate to bath.
h. Shut off steam—Add Glaubers salt—Run 30 minutes
i. Shut off steam—Add brine or rock salt—Run 30 minutes.
j. Sample—develop sample in lab—If shade OK
k. Wash over till cool, drop, and wash till clear.
l. Test for crocking—If it crocks give 2-4 washes at 90° F with pyro phosphate—See dyer.

Diazo Bath—Cold—30 Minutes

Add dissolved sodium nitrite to bath—Run 5 minutes.
Add diluted hydrochloric acid to bath—Run 30 minutes.
See dyer for lab. tests on bath.
Wash over and rinse twice.

Developing Bath

Add Acetic Acid—Run cold 5 minutes.

Add prepared BON solution to cold bath—Run 5 minutes.

Raise slowly to 130° F. on navy—Run 45 minutes—Check.

Raise slowly to 140-150° F. on black—Run 45 minutes.

Sample for shade—If OK, wash over till clear.

Run 1-3 washes at 90° F.—Test for crocking.

Add finish to final rinse at 90° F.—Run 10 minutes and take off.

Suggestion on Carrying Out the Standard Dyeing Procedures for Low Temperature Dyeing Crepe Fabrics

The general suggestions previously outlined under the high temperature dyeing crepes are applicable to these fabrics but there are additional precautions to observe. These are:

1. The colors must be selected with more care for these fabrics as they are more difficult of penetration and are run at a lower temperature which does not aid penetration. Particular selection must be used on substantive rayon colors used.

2. Use penetration agents that possess the highest penetrative properties, good stability, and do not foam excessively as this tends to make these heavier crepes float.

3. The lower dyeing temperatures and longer dyeing periods are necessary to prevent excessive shrinkage and break marks usually caused when these heavier crepes are dyed at high dyeing temperatures.

4. It is best to keep the dye-bath "freshened" with phosphate compounds as they aid in preventing a too rapid exhaustion of the substantive colors and assist the fatty alcoholates to disperse the acetate colors to a certain degree. The pyro phosphates appear to possess this solubilizing action on the dyestuffs more than T.S.P. or soda ash.

(To be continued)

OPEN FORUM

Rules under which this department of the REPORTER is conducted are as follows:

1. Anyone who has a technical problem on which he would like advice may submit it to the Reporter and it will be published in the first available issue.

2. Any reader who feels that he has a solution of the problem may forward his reply to us and if we feel that the reply is suitable it will be published in a succeeding issue.

3. For each such reply published the Reporter will pay a minimum of $2.

4. In case there is more than one answer to the same question, the one covering the subject in the most complete and authentic manner will be published, or if two answers are sufficiently different both will be published. If two answers are considered equally good, the one first received will be given priority.

5. The Reporter will assume no responsibility whatsoever for the accuracy of the answers submitted—it is simply offering a vehicle for the public expression of its readers' opinions.

6. Both the questioner and answerer must send in his complete name and address. When requested we will publish only the initials or other identifying insignia.

Answer

46—A discussion has arisen in our plant as to the actual physical causes of scroop on silk fibers. Is this effect visible under the microscope, and if not, what is the actual physical change between unscrooped and scrooped silk? Several theories have been evolved with regard to this, none of which seem to hold water, and I would appreciate it very much if some one could assist me in shedding some light on this subject.—**A.G.A.**

First of all, scroop is not characteristic to silk only and may be obtained on vegetable and synthetic fibers alike by suitable treatments.

Scroop has not been measured as yet, in fact, its definition is difficult enough because of such varied stipulations as acid scroop, oil scroop, dry scroop, harsh scroop, dead scroop.

Scroop cannot be detected microscopically, but it is from all indications a surface film effect whereby probably such phenomena as adhesion, tackiness, film thickness, electrical charges are of importance. That a surface deposit is responsible for scroop may be evidenced by a simple experiment: A scrooped yarn when continuously fed through a small orifice loses its scroop almost completely due to mechanical removal of the surface film.

Scroop is produced by the well known organic acids formic, acetic, lactic and oleic acid, the latter being invariably deposted when scouring of boiled-off silk is done with hydrochloric acid.

Most scroop effects lack permanency due to volatility as in the case of formic and acetic acid. Lactic acid scroop has not always met with approval and oleic acid scroop is apt to give rise to rancidity.

New organic compounds have been developed which properly applied give remarkable scroop effects of great permanency. They are characterized by complete absence of acidic substances which are often objectionable for obvious and various reasons.

The writer is glad to discuss the subject and the application of scroop in detail with anyone interested.

E. Gansel.

CLASSIFIED

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

WANTED: Position open in Textile Specialty House, Philadelphia vicinity for Chemist with Cotton and Rayon finishing and dyeing experience, preferably one familiar with the make-up and manufacture of oils, softeners, sizes, etc., used in the industry. Good future assured to the proper man. Permanent position. State expected salary in first letter. Write Box No. 160, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Young textile chemist with two years' experience in dye and print works. Good practical knowledge. Write Box No. 163, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: By textile school graduate. (Chemistry, dyeing and finishing course.) Age 22. Good at analytical work. Some experience in dyeing vats, naphthols and direct colors. Will go anywhere. Write Box No. 164, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

RESEARCH CHEMIST WANTED: Factory in Hudson County, New Jersey, offers position to Research Chemist, experienced in textile finishing and dyeing. Write Box No. 165, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.